MITSUBISHI ELECTRIC

General-Purpose AC Servo

MITSUBISHI SERVO AMPLIFIERS & MOTORS
MELSERVO-J4

Conversion Unit for SSCNET of MR-J2S-B Compatible AC Servo

MODEL (Servo Amplifier)

MR-J4-_B-RJ020
MR-J4-_B4-RJ020
MR-J4-_B1-RJ020

MODEL (Conversion Unit for SSCNET of MR-J2S-B)

MR-J4-T20

SERVO AMPLIFIER
INSTRUCTION MANUAL

C

● Safety Instructions ●

Please read the instructions carefully before using the equipment.

To use the equipment correctly, do not attempt to install, operate, maintain, or inspect the equipment until you have read through this Instruction Manual, Installation guide, and appended documents carefully. Do not use the equipment until you have a full knowledge of the equipment, safety information and instructions.
In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight injury to personnel or may cause physical damage.

Note ⚠ that the CAUTION level may lead to a serious consequence according to conditions.
Please follow the instructions of both levels because they are important to personnel safety.
What must not be done and what must be done are indicated by the following diagrammatic symbols.

⃠	Indicates what must not be done. For example, "No Fire" is indicated by ⃠.
●	Indicates what must be done. For example, grounding is indicated by ⏚.

In this Instruction Manual, instructions at a lower level than the above, instructions for other functions, and so on are classified into "POINT".
After reading this Instruction Manual, keep it accessible to the operator.

1. To prevent electric shock, note the following

⚠ WARNING

- Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.
- Ground the servo amplifier and servo motor securely.
- Any person who is involved in wiring and inspection should be fully competent to do the work.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
- Do not operate switches with wet hands. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- During power-on or operation, do not open the front cover of the servo amplifier. Otherwise, it may cause an electric shock.
- Do not operate the servo amplifier with the front cover removed. High-voltage terminals and charging area are exposed and you may get an electric shock.
- Except for wiring and periodic inspection, do not remove the front cover of the servo amplifier even if the power is off. The servo amplifier is charged and you may get an electric shock.
- To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.
- When using an earth-leakage current breaker (RCD), select the type B.
- To avoid an electric shock, insulate the connections of the power supply terminals.

2. To prevent fire, note the following

⚠ CAUTION

- Install the servo amplifier, servo motor, and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to a fire.
- Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- When using the regenerative resistor, switch power off with the alarm signal. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier, servo motor, and MR-J4-T20.
- Always connect a molded-case circuit breaker to the power supply of the servo amplifier.

3. To prevent injury, note the following

⚠ CAUTION

- Only the voltage specified in the Instruction Manual should be applied to each terminal. Otherwise, a burst, damage, etc. may occur.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- The servo amplifier heat sink, regenerative resistor, servo motor, etc. may be hot while power is on or for some time after power-off. Take safety measures, e.g. provide covers, to avoid accidentally touching the parts (cables, etc.) by hand.

4. Additional instructions

The following instructions should also be fully noted. Incorrect handling may cause a malfunction, injury, electric shock, etc.

(1) Transportation and installation

⚠ CAUTION

- Transport the products correctly according to their mass.
- Stacking in excess of the specified number of product packages is not allowed.
- Do not hold the front cover when transporting the servo amplifier. Otherwise, it may drop.
- Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
- Do not get on or put heavy load on the equipment.
- The equipment must be installed in the specified direction.
- Leave specified clearances between the servo amplifier and the cabinet walls or other equipment.
- Do not install or operate the servo amplifier and MR-J4-T20 which have been damaged or have any parts missing.
- Do not block the intake and exhaust areas of the servo amplifier and MR-J4-T20. Otherwise, it may cause a malfunction.
- Do not drop or strike the servo amplifier, servo motor, and MR-J4-T20. Isolate them from all impact loads.
- When you keep or use the equipment, please fulfill the following environment.

Item		Environment
Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)
	Storage	-20 ˚C to 65 ˚C (non-freezing)
Ambient humidity	Operation	90 %RH or less (non-condensing)
	Storage	
Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt
Altitude		1000 m or less above sea level
Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)

- When the product has been stored for an extended period of time, contact your local sales office.
- When handling the servo amplifier and MR-J4-T20, be careful about the edged parts such as corners of them.
- The servo amplifier and MR-J4-T20 must be installed in a metal cabinet.

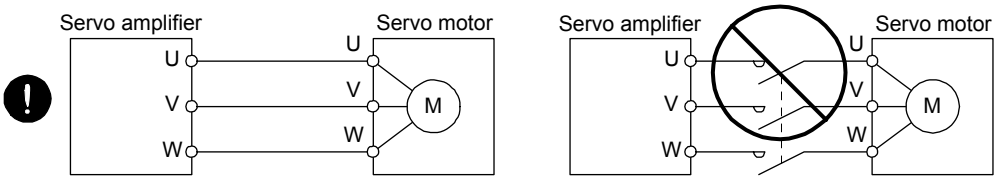
⚠ CAUTION

●When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products.
Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method).
Additionally, disinfect and protect wood from insects before packing products.

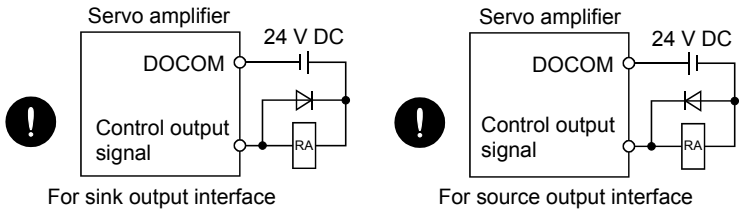
(2) Wiring

⚠ CAUTION

●Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly.
●Do not install a power capacitor, surge killer, or radio noise filter (optional FR-BIF-(H)) on the servo amplifier output side.
●To avoid a malfunction, connect the wires to the correct phase terminals (U, V, and W) of the servo amplifier and servo motor.
●Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



●The connection diagrams in this Instruction Manual are shown for sink interfaces, unless stated otherwise.
●The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



For sink output interface　　For source output interface

●When the cable is not tightened enough to the terminal block, the cable or terminal block may generate heat because of the poor contact. Be sure to tighten the cable with specified torque.
●Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

(3) Test run and adjustment

⚠ CAUTION

- Before operation, check the parameter settings. Improper settings may cause some machines to operate unexpectedly.
- Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.
- Do not get close to moving parts during the servo-on status.

(4) Usage

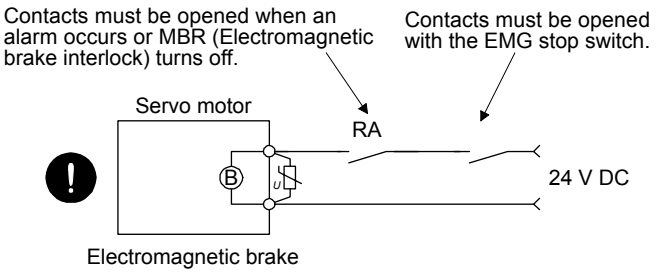
⚠ CAUTION

- When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with an external brake to prevent the condition.
- Do not disassemble, repair, or modify the equipment.
- Before resetting an alarm, make sure that the run signal of the servo amplifier is off in order to prevent a sudden restart. Otherwise, it may cause an accident.
- Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the servo amplifier.
- Burning or breaking a servo amplifier may cause a toxic gas. Do not burn or break it.
- Use the servo amplifier with the specified servo motor.
- The electromagnetic brake on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking.
- For such reasons as service life and mechanical structure (e.g. where a ball screw and the servo motor are coupled via a timing belt), the electromagnetic brake may not hold the motor shaft. To ensure safety, install a stopper on the machine side.

(5) Corrective actions

⚠ CAUTION

- When it is assumed that a hazardous condition may occur due to a power failure or product malfunction, use a servo motor with an electromagnetic brake or external brake to prevent the condition.
- Configure an electromagnetic brake circuit so that it is activated also by an external EMG stop switch.


Contacts must be opened when an alarm occurs or MBR (Electromagnetic brake interlock) turns off.
Contacts must be opened with the EMG stop switch.
Servo motor
RA
24 V DC
Electromagnetic brake

- When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- Provide an adequate protection to prevent unexpected restart after an instantaneous power failure.

(6) Maintenance, inspection and parts replacement

⚠ CAUTION
●With age, the electrolytic capacitor of the servo amplifier will deteriorate. To prevent a secondary accident due to a malfunction, it is recommend that the electrolytic capacitor be replaced every 10 years when it is used in general environment. Please contact your local sales office.

(7) General instruction

●To illustrate details, the equipment in the diagrams of this Instruction Manual may have been drawn without covers and safety guards. When the equipment is operated, the covers and safety guards must be installed as specified. Operation must be performed in accordance with this Instruction Manual.

● DISPOSAL OF WASTE ●

Please dispose a servo amplifier, battery (primary battery) and other options according to your local laws and regulations.

⚠ EEP-ROM life

The number of write times to the EEP-ROM, which stores parameter settings, etc., is limited to 100,000. If the total number of the following operations exceeds 100,000, the servo amplifier may malfunction when the EEP-ROM reaches the end of its useful life.

- Write to the EEP-ROM due to parameter setting changes
- Write to the EEP-ROM due to device changes

STO function of the servo amplifier

The STO function cannot be used when the servo amplifier is in the J2S compatibility mode.
To use the STO function, switch the operation mode to J4 mode. Refer to section 13.1 for the mode switching procedure.

Compliance with global standards

Refer to appendix 5 for the compliance with global standard.

«About the manuals»

You must have this Instruction Manual and the following manuals to use this servo. Ensure to prepare them to use the servo safely.

Relevant manuals

Manual name	Manual No.
MELSERVO Servo Motor Instruction Manual (Vol. 3)	SH(NA)030113
Instructions and Cautions for Drive of HC/HA Series Servo Motor with MR-J4_B_-RJ020 Servo Amplifier	SH(NA)030126
Conversion unit for SSCNET of MR-J2S-B MR-J4-T20 Instruction Manual (Packed with MR-J4-T20.)	IB(NA)0300204
EMC Installation Guidelines	IB(NA)67310

«Wiring»

Wires mentioned in this Instruction Manual are selected based on the ambient temperature of 40 ˚C.

MEMO

CONTENTS

1. FUNCTIONS AND CONFIGURATION 1- 1 to 1-40

1.1 Summary 1- 1
1.2 Function block diagram 1- 2
1.3 Standard specifications 1- 8
1.3.1 Servo amplifier standard specifications 1- 8
1.3.2 Conversion unit for SSCNET of MR-J2S-B 1-12
1.4 Combinations of servo amplifiers and servo motors 1-13
1.5 Function list 1-15
1.6 Model designation 1-16
1.7 Structure 1-17
1.7.1 Parts identification 1-17
1.7.2 Parts identification of MR-J4-T20 1-24
1.7.3 Removal and reinstallation of the front cover 1-25
1.8 Installation and removal of MR-J4-T20 1-27
1.9 Configuration including peripheral equipment 1-32

2. INSTALLATION 2- 1 to 2- 6

2.1 Installation direction and clearances 2- 2
2.2 Keep out foreign materials 2- 4
2.3 Encoder cable stress 2- 4
2.4 Inspection items 2- 5
2.5 Parts having service lives 2- 6

3. SIGNALS AND WIRING 3- 1 to 3-34

3.1 Input power supply circuit 3- 2
3.2 I/O signal connection example 3-12
3.2.1 For sink I/O interface 3-12
3.2.2 For source I/O interface 3-14
3.3 Explanation of power supply system 3-15
3.3.1 Signal explanations 3-15
3.3.2 Power-on sequence 3-17
3.3.3 Wiring CNP1, CNP2, and CNP3 3-18
3.4 Connectors and pin assignment 3-21
3.5 Signal (device) explanations 3-23
3.5.1 Input device 3-23
3.5.2 Output device 3-23
3.5.3 Output signal 3-24
3.5.4 Power supply 3-24
3.6 Alarm occurrence timing chart 3-25
3.7 Interfaces 3-26
3.7.1 Internal connection diagram 3-26
3.7.2 Detailed explanation of interfaces 3-27
3.7.3 Source I/O interfaces 3-29
3.8 Servo motor with an electromagnetic brake 3-30
3.8.1 Safety precautions 3-30

3.8.2 Timing chart 3-31
3.9 Grounding 3-34

4. STARTUP 4- 1 to 4-14

4.1 Switching power on for the first time 4- 2
4.1.1 Startup procedure 4- 2
4.1.2 Wiring check 4- 3
4.1.3 Surrounding environment 4- 5
4.2 Startup 4- 6
4.3 Switch setting and display of the servo amplifier 4- 7
4.3.1 Switches 4- 7
4.3.2 Status display of an axis 4- 9
4.4 Test operation 4-11
4.5 Test operation mode 4-11
4.5.1 Test operation mode in MR Configurator 4-12
4.5.2 Motor-less operation in controller 4-14

5. PARAMETERS 5- 1 to 5-18

5.1 Parameter list 5- 1
5.1.1 Basic setting parameters 5- 1
5.1.2 Adjustment parameters 5- 2
5.1.3 Extension parameters 5- 2
5.2 Detailed list of parameters 5- 4
5.2.1 Basic setting parameters 5- 4
5.2.2 Adjustment parameters 5- 9
5.2.3 Extension parameters 5-12

6. NORMAL GAIN ADJUSTMENT 6- 1 to 6-10

6.1 Different adjustment methods 6- 1
6.1.1 Adjustment on a single servo amplifier 6- 1
6.1.2 Adjustment using MR Configurator 6- 3
6.2 Auto tuning 6- 3
6.2.1 Auto tuning mode 6- 3
6.2.2 Auto tuning mode basis 6- 4
6.2.3 Adjustment procedure by auto tuning 6- 5
6.2.4 Response level setting in auto tuning mode 6- 6
6.3 Manual mode 1 (simple manual adjustment) 6- 7
6.3.1 Manual mode 1 basis 6- 7
6.3.2 Adjustment by manual mode 1 ..... 6- 7
6.4 Interpolation mode 6- 9

7. SPECIAL ADJUSTMENT FUNCTIONS 7- 1 to 7- 8

7.1 Filter setting 7- 1
7.1.1 Machine resonance suppression filter 7- 1
7.1.2 Low-pass filter 7- 3
7.2 Gain switching function 7- 3
7.2.1 Applications 7- 3

7.2.2 Function block diagram 7- 4
7.2.3 Parameter 7- 5
7.2.4 Gain switching procedure 7- 7

8. TROUBLESHOOTING 8- 1 to 8-14

8.1 Alarm and warning list 8- 1
8.2 Remedies for alarms 8- 2
8.3 Remedies for warnings 8-12
8.4 Troubleshooting at power on 8-14

9. DIMENSIONS 9- 1 to 9-20

9.1 Servo amplifier 9- 1
9.2 MR-J4-T20 9-16
9.3 Connectors 9-17
9.3.1 Servo amplifier side connectors 9-17
9.3.2 MR-J4-T20 connectors 9-19

10. CHARACTERISTICS 10- 1 to 10-14

10.1 Overload protection characteristics 10- 1
10.2 Power supply capacity and generated loss 10- 4
10.3 Dynamic brake characteristics 10- 7
10.3.1 Dynamic brake operation 10- 7
10.3.2 Permissible load to motor inertia when the dynamic brake is used 10-10
10.4 Cable bending life 10-11
10.5 Inrush currents at power-on of main circuit and control circuit 10-12

11. OPTIONS AND PERIPHERAL EQUIPMENT 11- 1 to 11-94

11.1 Cable/connector sets 11- 1
11.1.1 Combinations of cable/connector sets 11- 2
11.1.2 SSCNET cable 11- 5
11.1.3 RS-232C communication cable 11- 9
11.2 Regenerative option 11-11
11.2.1 Combination and regenerative power 11-11
11.2.2 Selection of the regenerative option 11-13
11.2.3 Parameter setting 11-15
11.2.4 Selection of the regenerative option 11-16
11.2.5 Dimensions 11-20
11.3 FR-BU2-(H) brake unit 11-24
11.3.1 Selection 11-25
11.3.2 Brake unit parameter setting 11-25
11.3.3 Connection example 11-26
11.3.4 Dimensions 11-34
11.4 FR-RC-(H) power regenerative converter 11-36
11.5 FR-CV-(H) power regenerative common converter 11-40
11.5.1 Model definition 11-40
11.5.2 Selection 11-40
11.6 Junction terminal block PS7DW-20V14B-F (recommended) 11-47

11.7 MR Configurator 11-48
11.7.1 Specifications 11-48
11.7.2 Additional instructions 11-49
11.7.3 System requirements 11-50
11.7.4 Precautions for using RS-232C communication function 11-53
11.8 Battery 11-54
11.8.1 MR-BAT6V1SET battery 11-54
11.8.2 MR-BAT6V1BJ battery for junction battery cable 11-54
11.9 Selection example of wires 11-55
11.10 Molded-case circuit breakers, fuses, magnetic contactors (recommended) 11-60
11.11 Power factor improving DC reactor 11-62
11.12 Power factor improving AC reactor 11-65
11.13 Relay (recommended) 11-68
11.14 Noise reduction techniques 11-69
11.15 Earth-leakage current breaker 11-76
11.16 EMC filter (recommended) 11-79
11.17 External dynamic brake 11-83
11.18 Heat sink outside mounting attachment (MR-J4ACN15K/MR-J3ACN) 11-89

12. ABSOLUTE POSITION DETECTION SYSTEM 12- 1 to 12-12

12.1 Summary 12- 1
12.1.1 Features 12- 1
12.1.2 Structure 12- 2
12.1.3 Parameter setting 12- 2
12.1.4 Confirmation of absolute position detection data 12- 3
12.2 Battery 12- 4
12.2.1 Using MR-BAT6V1SET battery 12- 4
12.2.2 Using MR-BAT6V1BJ battery for junction battery cable 12- 9

13. USING THE MR-J4-_B_-RJ020 SERVO AMPLIFIER IN THE J4 MODE 13- 1 to 13-50

13.1 Mode switching procedure 13- 1
13.1.1 Switching from the J2S compatibility mode to the J4 mode 13- 1
13.1.2 Switching from the J4 mode to the J2S compatibility mode 13- 2
13.2 Parameter 13- 2
13.2.1 Parameter list 13- 3
13.2.2 Detailed list of parameters 13-12
13.3 Troubleshooting 13-45
13.3.1 Alarm and warning list 13-45
13.3.2 Troubleshooting at power on 13-50

APPENDIX App. - 1 to App. -32

App. 1 Using the HC series/HA series servo motor ..... App.- 1
App. 2 Peripheral equipment manufacturer (for reference) ..... App.- 3
App. 3 Handling of AC servo amplifier batteries for the United Nations Recommendations on the Transport of Dangerous Goods ..... App.- 3
App. 4 Symbol for the new EU Battery Directive ..... App.- 5
App. 5 Compliance with global standards ..... App.- 5
App. 6 Analog monitor App.-21

App. 7 Special specification App.-24
App. 8 Setting of added parameters for MR-J4-_B_-RJ020 servo amplifier App.-26

MEMO

1. FUNCTIONS AND CONFIGURATION

1.1 Summary

This Instruction Manual explains about the MR-J4-_B_-RJ020 AC servo amplifiers compatible with a conversion unit for SSCNET of MR-J2S-B, and the MR-J4-T20 conversion unit for SSCNET of MR-J2S-B. Always use MR-J4-T20 with MR-J4-_B_-RJ020.
MR-J4-_B_-RJ020 can be connected to SSCNET of MR-J2S-B by being used with MR-J4-T20.
MR-J4-_B_-RJ020 servo amplifiers have "J2S compatibility mode (factory setting)" and "J4 mode" as the operation mode. The "J2S compatibility mode" is the operation mode compatible with the previous functions of the MR-J2S-B series.
This Instruction Manual explains when the "J2S compatibility mode" is used except for in chapter 13.
When using the servo amplifier in "J4 mode", refer to chapter 13.
When you use an MR-J4-_B_-RJ020 servo amplifier, please note the following items.

(1) When using an HG series servo motor with the J2S compatibility mode, the encoder resolution per servo motor revolution will not be 4194304 pulses/rev (22 bits) but 131072 pulses/rev (17 bits).

(2) It may be required to change existing equipment program because the initialization time after power on is different between MR-J2S-_B_ servo amplifier and MR-J4-_B_-RJ020 servo amplifier. Especially when using it in vertical motion applications, please be careful of electromagnetic brake release time. The moving part can fall.

(3) Motor-less operation cannot be used with MR Configurator. To use motor-less operation, set "_ 1 _ _" in [Pr. 24].

(4) When using [Pr. 13 Position loop gain 1] of MR-J4-_B_-RJ020 and MR-J2S-_B_ simultaneously such as in the interpolation mode, check droop pulses for each axis and readjust gains as necessary.

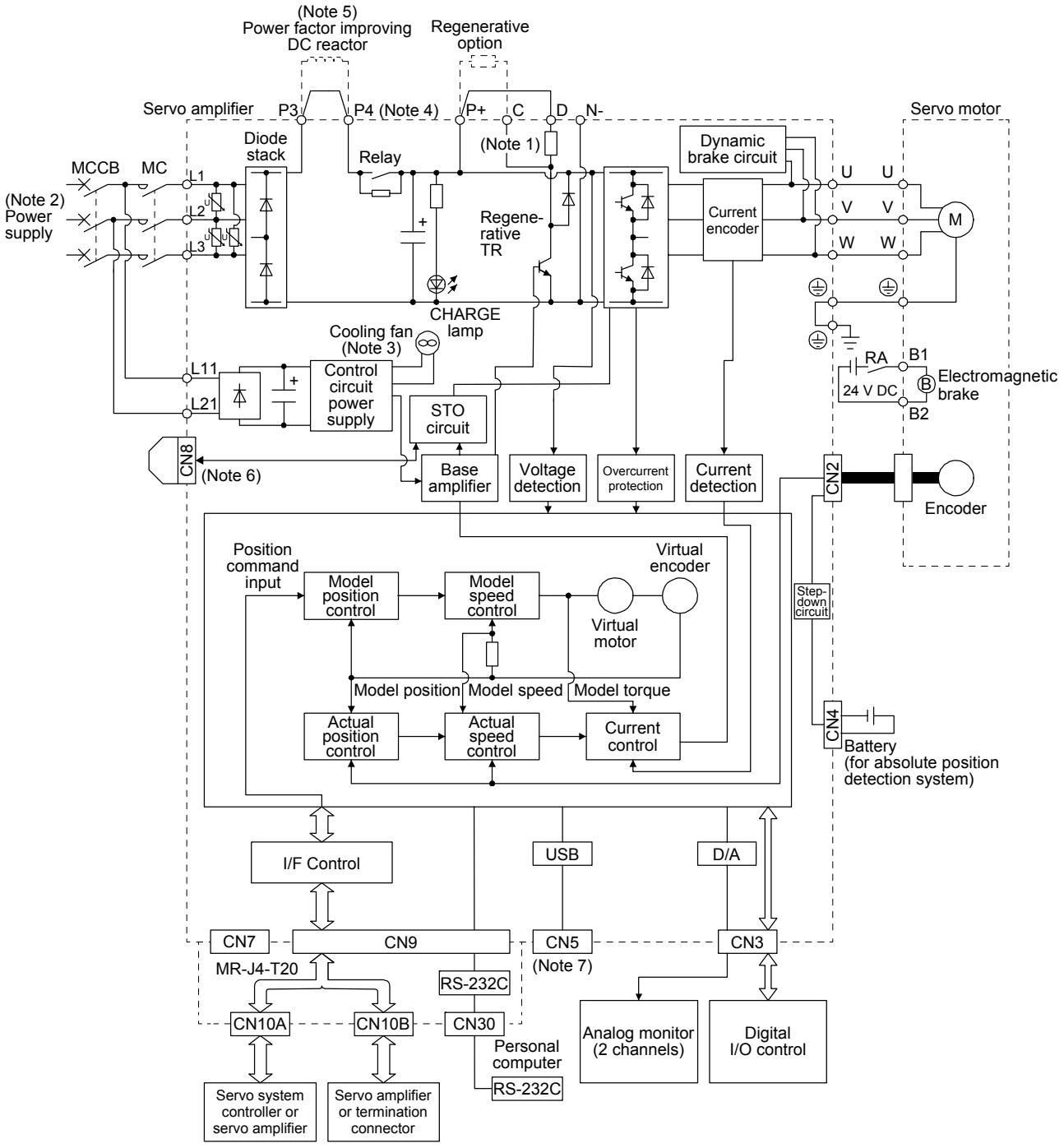
(5) MR-J4-_B_-RJ020 servo amplifier is not compatible with adaptive vibration suppression control.

(6) Power is not supplied from the SSCNET cable connection connector to the encoder. When using the MR-J4-_B_-RJ020 servo amplifier in absolute position detection system, always connect a battery to the CN4 connector.

1.2 Function block diagram

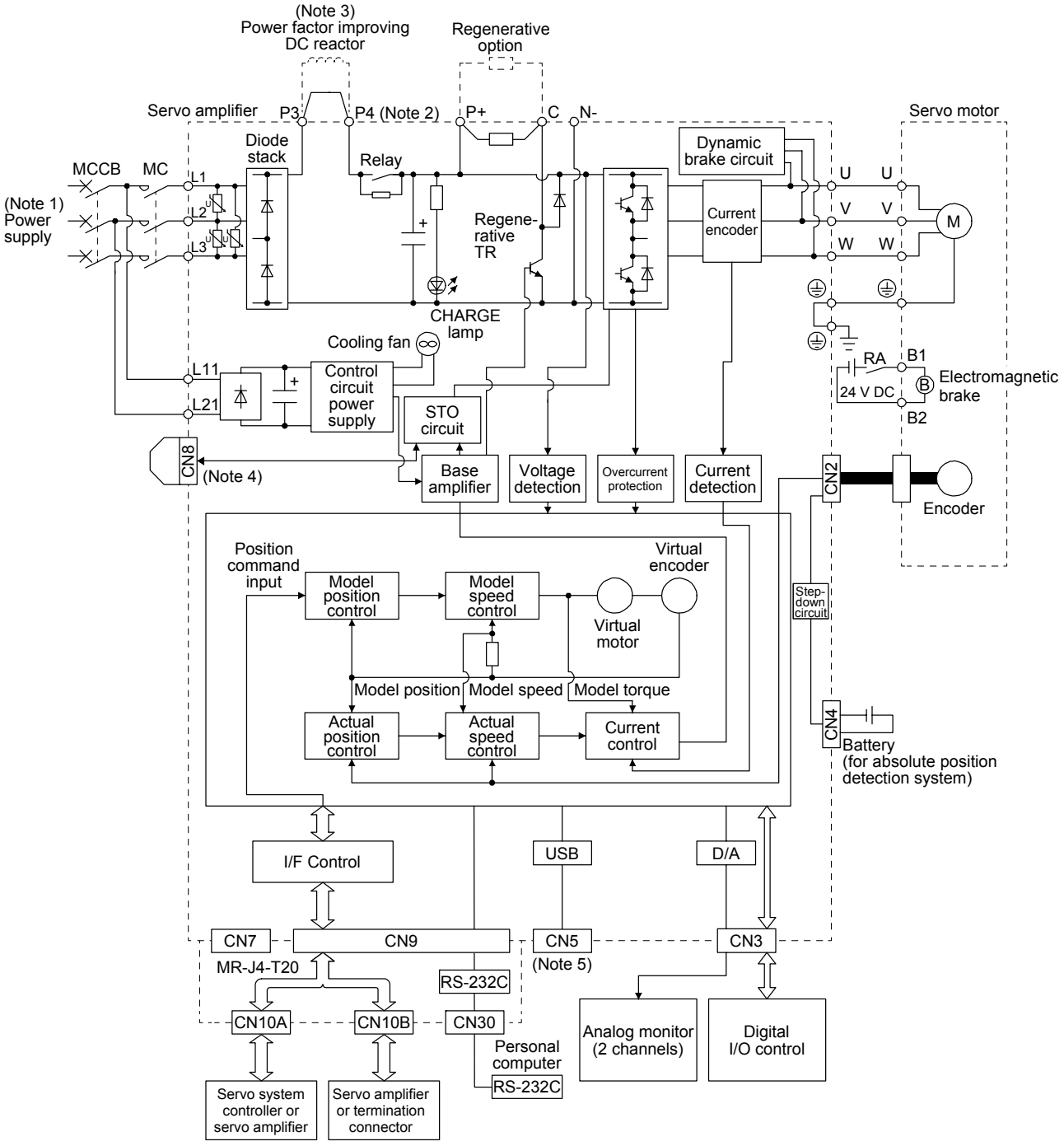
The function block diagram of this servo is shown below.

(1) MR-J4-500B-RJ020 or less/MR-J4-350B4-RJ020 or less



Note 1. The built-in regenerative resistor is not provided for MR-J4-10B-RJ020.
2. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.
For power supply specifications, refer to section 1.3.1.
3. The MR-J4-70B-RJ020 or more, MR-J4-200B4-RJ020 and MR-J4-350B4-RJ020 servo amplifiers have a cooling fan.
4. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
5. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
6. This is not used when the servo amplifier is in the J2S compatibility mode. Always attach the short-circuit connector came with a servo amplifier.
7. Used to change the servo amplifier mode. Refer to section 13.1 for the mode selection procedure.

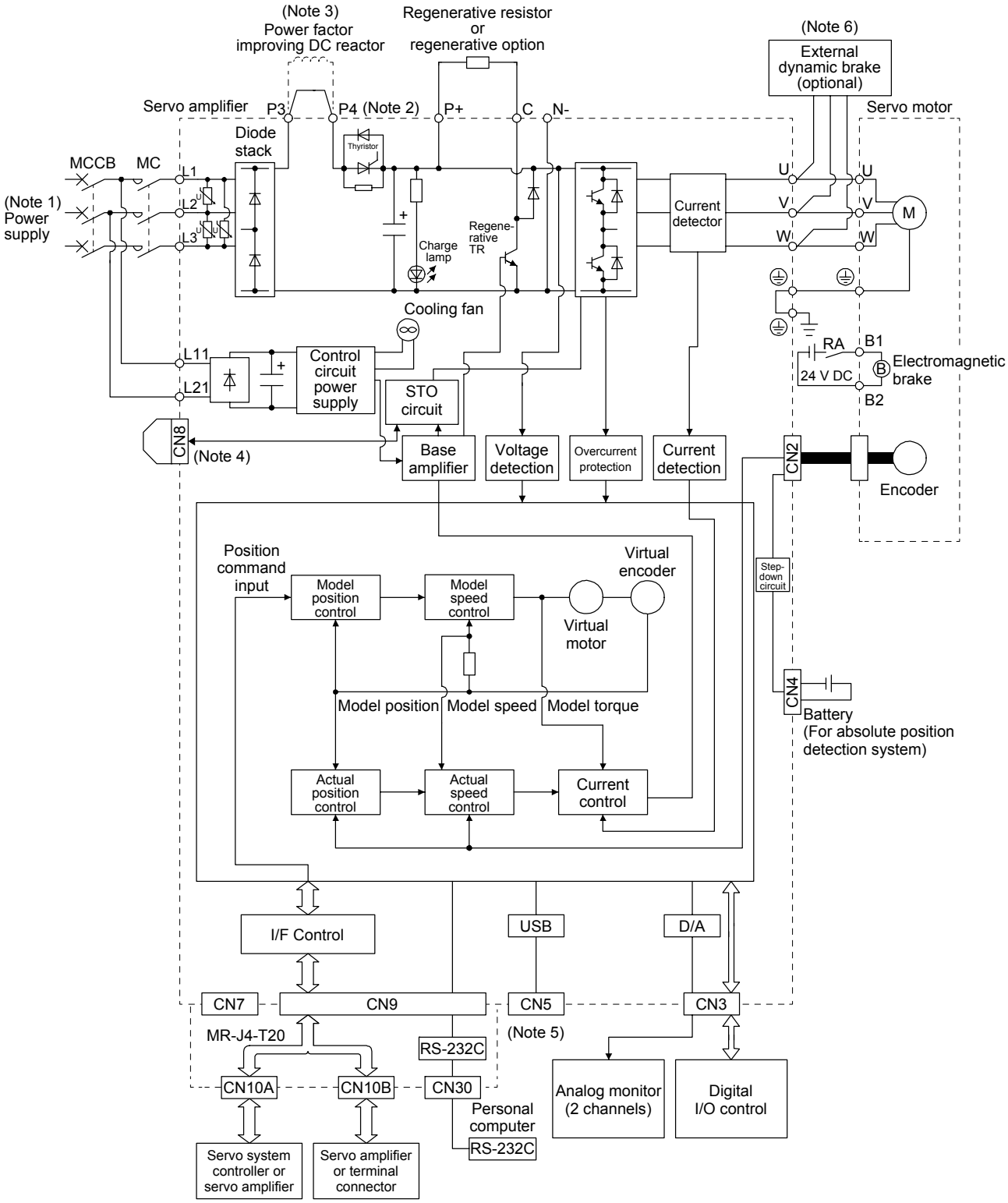
(2) MR-J4-700B-RJ020/MR-J4-500B4-RJ020/MR-J4-700B4-RJ020



Note 1. For power supply specifications, refer to section 1.3.1.

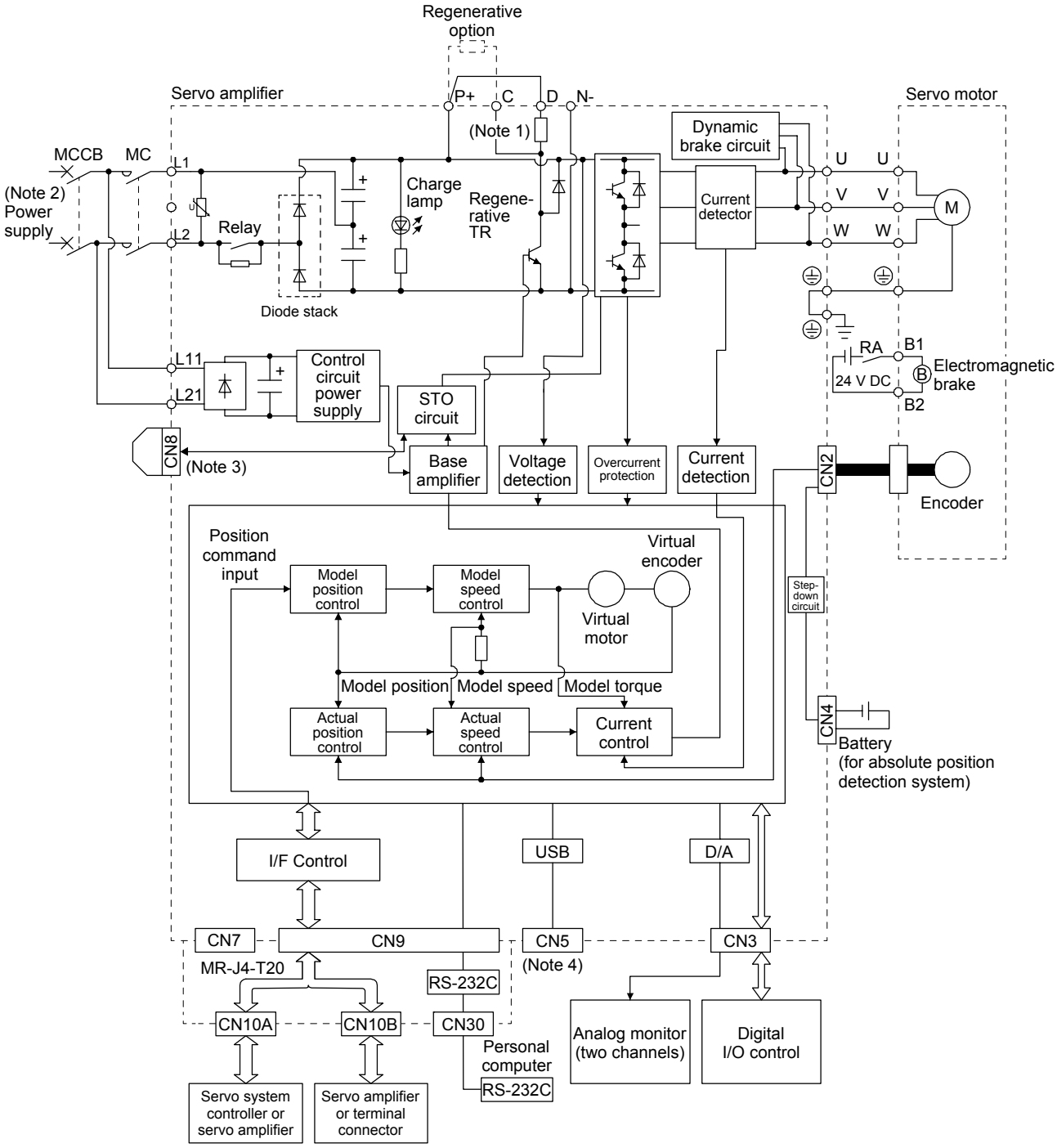
2. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
3. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
4. This is not used when the servo amplifier is in the J2S compatibility mode. Always attach the short-circuit connector came with a servo amplifier.
5. Used to change the servo amplifier mode. Refer to section 13.1 for the mode selection procedure.

(3) MR-J4-11KB-RJ020/MR-J4-15KB-RJ020/MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020/
MR-J4-15KB4-RJ020/MR-J4-22KB4-RJ020



Note 1. For power supply specifications, refer to section 1.3.1.
2. MR-J4 servo amplifier has P3 and P4 in the upstream of the inrush current suppression circuit. They are different from P1 and P2 of MR-J3 servo amplifiers.
3. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
4. This is not used when the servo amplifier is in the J2S compatibility mode. Always attach the short-circuit connector came with a servo amplifier.
5. This is used to change the servo amplifier mode. Refer to section 13.1 for the mode selection procedure.
6. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment.

(4) MR-J4-10B1-RJ020/MR-J4-20B1-RJ020/MR-J4-40B1-RJ020



Note 1. The built-in regenerative resistor is not provided for MR-J4-10B1-RJ020.
2. For power supply specifications, refer to section 1.3.1.
3. This is not used when the servo amplifier is in the J2S compatibility mode. Always attach the short-circuit connector came with a servo amplifier.
4. This is used to change the servo amplifier mode. Refer to section 13.1 for the mode selection procedure.

1.3 Standard specifications

1.3.1 Servo amplifier standard specifications

(1) 200 V class

Model: MR-J4-_-RJ020			10B	20B	40B	60B	70B	100B	200B	350B	500B	700B	11KB	15KB	22KB
Output	Rated voltage		3-phase 170 V AC												
	Rated current	[A]	1.1	1.5	2.8	3.2	5.8	6.0	11.0	17.0	28.0	37.0	68.0	87.0	126.0
Main circuit power supply input	Voltage/Frequency		3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz					3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz							
	Rated current (Note 6)	[A]	0.9	1.5	2.6	3.2 (Note 3)	3.8	5.0	10.5	16.0	21.7	28.9	46.0	64.0	95.0
	Permissible voltage fluctuation		3-phase or 1-phase 170 V AC to 264 V AC					3-phase 170 V AC to 264 V AC							
	Permissible frequency fluctuation		Within ±5%												
	Power supply capacity	[kVA]	Refer to section 10.2.												
	Inrush current	[A]	Refer to section 10.5.												
Control circuit power supply input	Voltage/Frequency		1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz												
	Rated current	[A]	0.2								0.3				
	Permissible voltage fluctuation		1-phase 170 V AC to 264 V AC												
	Permissible frequency fluctuation		Within ±5%												
	Power consumption	[W]	30								45				
	Inrush current	[A]	Refer to section 10.5.												
Interface power supply	Voltage		24 V DC ± 10%												
	Current capacity	[A]	0.1												
Control method			Sine-wave PWM control, current control method												
Dynamic brake			Built-in										External option (Note 5)		
Fully closed loop control			Not available												
Load-side encoder interface															
Communication function	USB		Connection to a personal computer (compatible with an application "MR-J4(W)-B mode selection" (Note 4))												
Encoder output pulses			Compatible (A/B/Z-phase pulse)												
Analog monitor			Two channels												
Protective functions			Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection												
Functional safety			Not available												
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061												
	UL standard		UL 508C												
Structure (IP rating)			Natural cooling, open (IP20)				Force cooling, open (IP20)				Force cooling, open (IP20) (Note 2)				
Close mounting (Note 1)			Possible								Impossible				
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)												
		Storage	-20 ˚C to 65 ˚C (non-freezing)												
	Ambient humidity	Operation	90 %RH or less (non-condensing)												
		Storage													
	Ambience		Indoors (no direct sunlight),free from corrosive gas, flammable gas, oil mist, dust, and dirt												
	Altitude		1000 m or less above sea level												
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)												
Mass		[kg]	0.8	1.0		1.4		2.1	2.3		4.0	6.2	13.4		18.2

Note 1. When closely mounting the servo amplifier, operate them at the ambient temperatures of 0 ˚C to 45 ˚C or at 75% or smaller effective load ratio.
2. Except for the terminal block.
3. The rated current is 2.9 A when the servo amplifier is used with a UL or CSA compliant servo motor.
4. The application "MR-J4(W)-B mode selection" is necessary for using MR-J4-_B-RJ020 in the J4 mode.
It is unnecessary for using MR-J4-_B-RJ020 in the J2S compatibility mode. Use the application "MR-J4(W)-B mode selection" packed with MR Configurator2 of software version 1.17T or later.
5. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment.
6. This value is applicable when a 3-phase power supply is used.

(2) 400 V class

Model: MR-J4-_-RJ020			60B4	100B4	200B4	350B4	500B4	700B4	11KB4	15KB4	22KB4
Output	Rated voltage		3-phase 323 V AC								
	Rated current	[A]	1.5	2.8	5.4	8.6	14.0	17.0	32.0	41.0	63.0
Main circuit power supply input	Voltage/Frequency		3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz								
	Rated current	[A]	1.4	2.5	5.1	7.9	10.8	14.4	23.1	31.8	47.6
	Permissible voltage fluctuation		3-phase 323 V AC to 528 V AC								
	Permissible frequency fluctuation		Within ±5%								
	Power supply capacity	[kVA]	Refer to section 10.2.								
	Inrush current	[A]	Refer to section 10.5.								
Control circuit power supply input	Voltage/Frequency		1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz								
	Rated current	[A]	0.1			0.2					
	Permissible voltage fluctuation		1-phase 323 V AC to 528 V AC								
	Permissible frequency fluctuation		Within ±5%								
	Power consumption	[W]	30			45					
	Inrush current	[A]	Refer to section 10.5.								
Interface power supply	Voltage		24 V DC ± 10%								
	Current capacity	[A]	0.1								
Control method			Sine-wave PWM control, current control method								
Dynamic brake			Built-in						External option (Note 3)		
Fully closed loop control			Not available								
Load-side encoder interface											
Communication function	USB		Connection to a personal computer (compatible with an application "MR-J4(W)-B mode selection" (Note 2))								
Encoder output pulses			Compatible (A/B/Z-phase pulse)								
Analog monitor			Two channels								
Protective functions			Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection								
Functional safety			Not available								
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061								
	UL standard		UL 508C								
Structure (IP rating)			Natural cooling, open (IP20)		Force cooling, open (IP20)		Force cooling, open (IP20) (Note 1)				
Close mounting			Impossible								
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)								
		Storage	-20 ˚C to 65 ˚C (non-freezing)								
	Ambient humidity	Operation	90 %RH or less (non-condensing)								
		Storage									
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt								
	Altitude		1000 m or less above sea level								
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)								
Mass		[kg]	1.7		2.1	3.6	4.3	6.5	13.4		18.2

Note 1. Except for the terminal block.

2. The application "MR-J4(W)-B mode selection" is necessary for using MR-J4-_B4-RJ020 in the J4 mode. It is unnecessary for using MR-J4-_B4-RJ020 in the J2S compatibility mode. Use the application "MR-J4(W)-B mode selection" packed with MR Configurator2 of software version 1.17T or later.

3. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment.

(3) 100 V class

Model: MR-J4-_-RJ020			10B1	20B1	40B1
Output	Rated voltage		3-phase 170 V AC		
	Rated current [A]		1.1	1.5	2.8
Main circuit power supply input	Voltage/Frequency		1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz		
	Rated current [A]		3.0	5.0	9.0
	Permissible voltage fluctuation		1-phase 85 V AC to 132 V AC		
	Permissible frequency fluctuation		Within ±5%		
	Power supply capacity [kVA]		Refer to section 10.2.		
	Inrush current [A]		Refer to section 10.5.		
Control circuit power supply input	Voltage/Frequency		1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz		
	Rated current [A]		0.4		
	Permissible voltage fluctuation		1-phase 85 V AC to 132 V AC		
	Permissible frequency fluctuation		Within ±5%		
	Power consumption [W]		30		
	Inrush current [A]		Refer to section 10.5.		
Interface power supply	Voltage		24 V DC ± 10%		
	Current capacity [A]		0.1		
Control method			Sine-wave PWM control, current control method		
Dynamic brake			Built-in		
Fully closed loop control			Not available		
Load-side encoder interface					
Communication function	USB		Connection with the personal computer (compatible with an application software "MR-J4(W)-B mode selection" (Note 2))		
Encoder output pulses			Compatible (A/B/Z-phase pulse)		
Analog monitor			Two channels		
Protective functions			Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal), servo motor overheat protection, encoder error protection, regenerative error protection, undervoltage protection, instantaneous power failure protection, overspeed protection, and error excessive protection		
Functional safety			Not available		
Compliance to global standards	CE marking		LVD: EN 61800-5-1 EMC: EN 61800-3 MD: EN ISO 13849-1, EN 61800-5-2, EN 62061		
	UL standard		UL 508C		
Structure (IP rating)			Natural cooling, open (IP20)		
Close mounting (Note 1)			Possible		
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)		
		Storage	-20 ˚C to 65 ˚C (non-freezing)		
	Ambient humidity	Operation	90 %RH or less (non-condensing)		
		Storage			
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt		
	Altitude		1000 m or less above sea level		
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)		
Mass [kg]			0.8		1.0

Note 1. When closely mounting the servo amplifier of 3.5 kW or less, operate them at the ambient temperatures of 0 ˚C to 45 ˚C or at 75% or smaller effective load ratio.

2. The application software "MR-J4(W)-B mode selection" is necessary for using MR-J4-_B1-RJ020 in J4 mode.
It is unnecessary when using MR-J4-_B1-RJ020 in J2S compatibility mode. Use the application "MR-J4(W)-B mode selection" which packed with MR Configurator2 of software version 1.17T or later.

1.3.2 Conversion unit for SSCNET of MR-J2S-B

Model			MR-J4-T20
Control circuit power supply	Voltage		5 V DC (supplied from the servo amplifier)
	Rated current [A]		0.1
Network interface			SSCNET interface (CN10A connector/CN10B connector)
Communication function	RS-232C		Connection to a personal computer (MR Configurator (MRZJW3-SETUP161E) (CN30 connector))
Structure			Natural-cooling, open (IP rating: IP00)
Environment	Ambient temperature	Operation	0 ˚C to 55 ˚C (non-freezing)
		Storage	-20 ˚C to 65 ˚C (non-freezing)
	Ambient humidity	Operation	90 %RH or less (non-condensing)
		Storage	
	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt
	Altitude		1000 m or less above sea level
	Vibration resistance		5.9 m/s^2, at 10 Hz to 55 Hz (directions of X, Y and Z axes)
Mass [g]			140

1.4 Combinations of servo amplifiers and servo motors

POINT

- When using the HG series servo motor with the MR-J4-_B_-RJ020 servo amplifier, the encoder resolution per servo motor revolution will not be 4194304 pulses/rev (22 bits) but 131072 pulses/rev (17 bits).
- To operate the HG series servo motor at the maximum torque, set the torque limit value in the servo system controller to 500%. When using the maximum torque in the test operation mode, set [Pr. 10 Forward rotation torque limit value] and [Pr. 11 Reverse rotation torque limit value] to 500%.

(1) 200 V class

Servo amplifier	Servo motor						
	HG-KR	HG-MR	HG-SR	HG-UR	HG-RR	HG-JR	HG-JR (at maximum torque 400%)
MR-J4-10B-RJ020	053 13	053 13					
MR-J4-20B-RJ020	23	23					
MR-J4-40B-RJ020	43	43					
MR-J4-60B-RJ020			51 52			53	
MR-J4-70B-RJ020	73	73		72		73	
MR-J4-100B-RJ020			81 102			103	53
MR-J4-200B-RJ020			121 201 152 202	152	103 153	153 203	73 103
MR-J4-350B-RJ020			301 352	202	203	353	153 203
MR-J4-500B-RJ020			421 502	352 502	353 503	503	353
MR-J4-700B-RJ020			702			703	503
MR-J4-11KB-RJ020						903 11K1M	
MR-J4-15KB-RJ020						15K1M	
MR-J4-22KB-RJ020						22K1M	

(2) 400 V class

Servo amplifier	Servo motor		
	HG-SR	HG-JR	HG-JR (at maximum torque 400%)
MR-J4-60B4-RJ020	524	534	
MR-J4-100B4-RJ020	1024	734 1034	534
MR-J4-200B4-RJ020	1524 2024	1534 2034	734 1034
MR-J4-350B4-RJ020	3524	3534	1534 2034
MR-J4-500B4-RJ020	5024	5034	3534
MR-J4-700B4-RJ020	7024	7034	5034
MR-J4-11KB4-RJ020		9034 11K1M4	
MR-J4-15KB4-RJ020		15K1M4	
MR-J4-22KB4-RJ020		22K1M4	

(3) 100 V class

Servo amplifier	Servo motor	
	HG-KR	HG-MR
MR-J4-10B1-RJ020	053 13	053 13
MR-J4-20B1-RJ020	23	23
MR-J4-40B1-RJ020	43	43

1.5 Function list

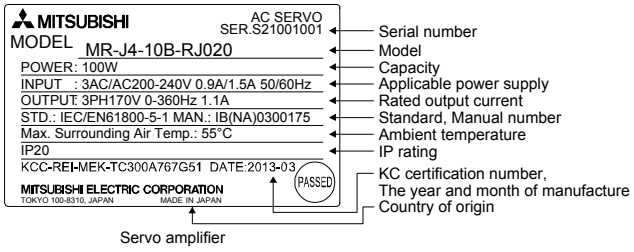
The following table lists the functions of this servo. For details of the functions, refer to each section indicated in the detailed explanation field.

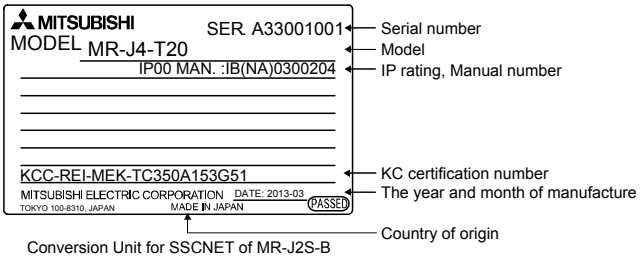
Function	Description	Detailed explanation
Position control mode	This servo is used as a position control servo.	
Speed control mode	This servo is used as a speed control servo.	
Torque control mode	This servo is used as a torque control servo.	
High-resolution encoder	When the servo amplifier is in the J2S compatibility mode, the encoder resolution of the servo amplifier will be 131072 pulses/rev.	
Absolute position detection system	Merely setting a home position once makes home position return unnecessary at every power-on.	Chapter 12
Gain switching function	You can switch gains during rotation and during stop, and can use an input device to switch gains during operation.	Section 7.2
Adaptive vibration suppression control	This is not available with this servo amplifier.	
Machine resonance suppression filter	This is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system.	Section 7.1.1
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 7.1.2
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting an MR Configurator installed personal computer and servo amplifier. MR Configurator is necessary for this function.	
Machine simulation	This is not available with this servo amplifier.	
Gain search function	This is not available with this servo amplifier.	
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	[Pr. 24]
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 6.2
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used for the 5 kW or more servo amplifier.	Section 11.3
Power regenerative converter	Used when the regenerative option cannot provide enough regenerative power. Can be used for the 5 kW or more servo amplifier.	Section 11.4
Regenerative option	Used when the built-in regenerative resistor of the servo amplifier does not have sufficient regenerative capability for the regenerative power generated.	Section 11.2
Torque limit	Servo motor torque can be limited to any value.	[Pr. 10], [Pr. 11]
EM1 (Forced stop) automatic on	This function automatically switches on and disables EM1 (Forced stop) in the servo amplifier.	[Pr. 23]
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for checking output signal wiring, etc.	Section 4.5.1 (1) (d)
Test operation mode	JOG operation, positioning operation, Do forced output, and program operation MR Configurator is necessary for this function.	Section 4.5.1
	Motor-less operation To use motor-less operation, set " _1_ _ " in [Pr. 24].	Section 4.5.2
Analog monitor output	Servo status is outputted in terms of voltage in real time.	[Pr. 22]
MR Configurator	Using a personal computer, you can perform the parameter setting, test operation, monitoring, and others. Use MRZJW3-SETUP161E for MR-J4-_B_-RJ020 servo amplifier.	Section 11.7
Linear servo system	This is not available with this servo amplifier.	
Direct drive servo system	This is not available with this servo amplifier.	
Fully closed loop system	This is not available with this servo amplifier.	
STO function	The STO function cannot be used when the servo amplifier is in J2S compatibility mode.	

1.6 Model designation

(1) Rating plate

The following shows an example of rating plate for explanation of each item.





(2) Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.

MR－J4－60B4－RJ020

Series

Special specifications

Symbol	Special specifications
RJ020	Compatible with the conversion unit for SSCNET of MR-J2S-B
RU020	MR-J4-_B_-RJ020 without a dynamic brake (Note 1)
RZ020	MR-J4-_B_-RJ020 without regenerative resistor (Note 2)

Note1. Dynamic brake which is built in 7 kw or smaller servo amplifiers is removed. Refer to Appendix 8.1 for details.

2. These are servo amplifiers of 11 kW to 22 kW that does not use a regenerative resistor as standard accessory. Refer to Appendix 8.2 for details.

Power supply

Symbol	Power supply
None	3-phase or 1-phase 200 V AC to 240 V AC
1	1-phase 100 V AC to 120 V AC
4	3-phase 380 V AC to 480 V AC

SSCNETIII/H interface

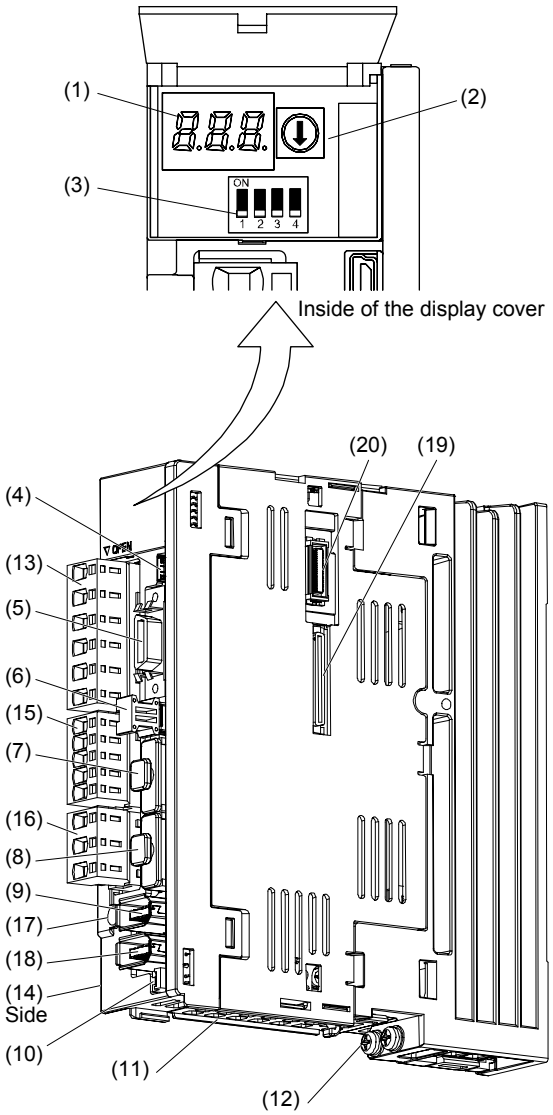
Rated output

Symbol	Rated output [kW]
10	0.1
20	0.2
40	0.4
60	0.6
70	0.75
100	1
200	2
350	3.5
500	5
700	7
11K	11
15K	15
22K	22

1.7 Structure

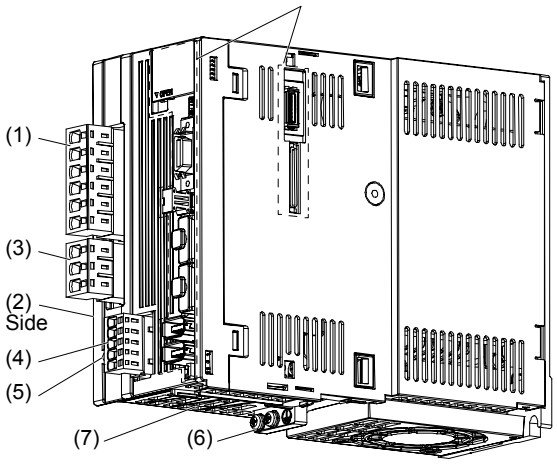
1.7.1 Parts identification

(1) MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less/MR-J4-40B1-RJ020 or less
The diagram shows MR-J4-10B-RJ020.



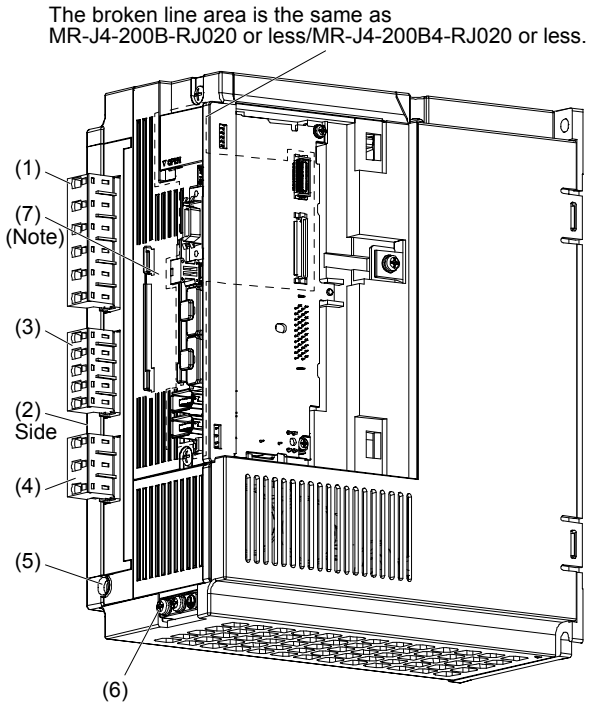
No.	Name/Application	Detailed explanation
(1)	Display The 3-digit, 7-segment LED shows the servo status and the alarm number.	Section 4.3
(2)	Axis selection rotary switch (SW1) Used to set the axis No. of servo amplifier.	
(3)	Control axis setting switch (SW2) Not used in J2S compatibility mode. Turn all switches "OFF (down)".)	
(4)	USB communication connector (CN5) Connect with the personal computer. Used to change the servo amplifier mode.	Section 13.1
(5)	I/O signal connector (CN3) Used to connect digital I/O signals. The pin assignments are different from the MR-J2S series. Wire it correctly in accordance with section 3.4.	Section 3.2 Section 3.4
(6)	STO input signal connector (CN8) Not used in J2S compatibility mode. Always attach the supplied short-circuit connector.	
(7)	SSCNET III cable connector (CN1A) Not used in J2S compatibility mode. Always cap the connector.	
(8)	SSCNET III cable connector (CN1B) Not used in J2S compatibility mode. Always cap the connector.	
(9)	Encoder connector (CN2) Used to connect the servo motor encoder.	Section 3.4 "Servo Motor Instruction Manual (Vol. 3)"
(10)	Battery connector (CN4) Used to connect the battery for absolute position data backup.	Chapter 12
(11)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(12)	Protective earth (PE) terminal Grounding terminal	Section 3.1 Section 3.3
(13)	Main circuit power connector (CNP1) Connect the input power supply.	
(14)	Rating plate	Section 1.6
(15)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	Section 3.1 Section 3.3
(16)	Servo motor power connector (CNP3) Connect the servo motor.	
(17)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(18)	Manufacturer setting connector (CN2L) This is not available with the servo amplifier.	
(19)	Optional unit connector (CN7) Connector used for connection with the CN70 connector of MR-J4-T20	
(20)	Optional unit connector (CN9) Connector used for connection with the CN90 connector of MR-J4-T20	

(2) MR-J4-350B-RJ020



No.	Name/Application	Detailed explanation
(1)	Main circuit power connector (CNP1) Connect the input power supply.	Section 3.1 Section 3.3
(2)	Rating plate	Section 1.6
(3)	Servo motor power connector (CNP3) Connect the servo motor.	Section 3.1 Section 3.3
(4)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	
(5)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(6)	Protective earth (PE) terminal Grounding terminal	Section 3.1 Section 3.3
(7)	Battery holder Install the battery for absolute position data backup.	Section 12.2

(3) MR-J4-350B4-RJ020



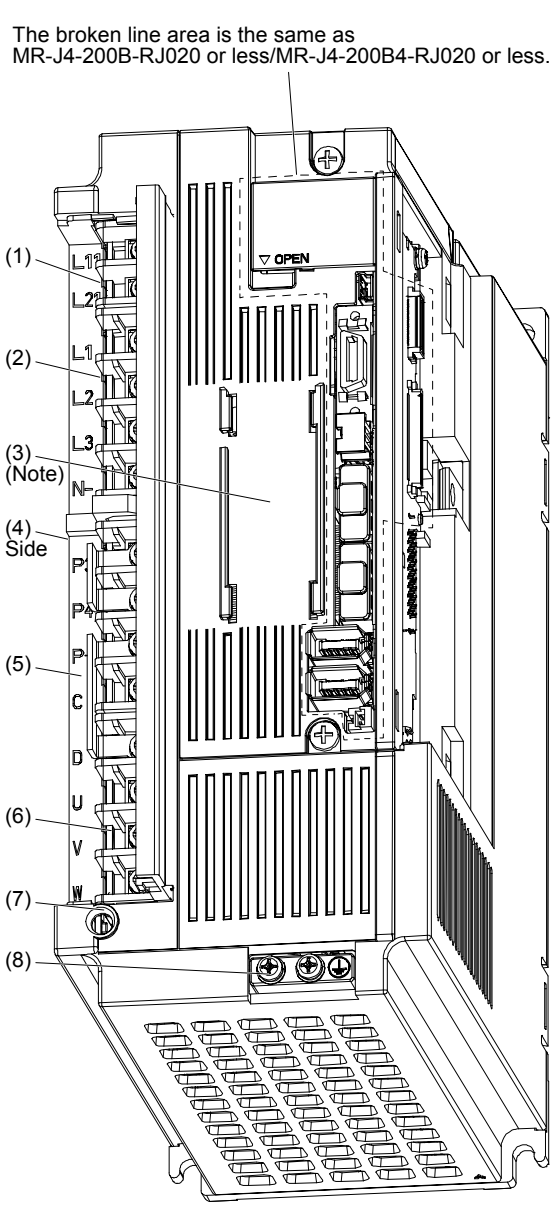
No.	Name/Application	Detailed explanation
(1)	Main circuit power connector (CNP1) Connect the input power supply.	Section 3.1 Section 3.3
(2)	Rating plate	Section 1.6
(3)	Control circuit power connector (CNP2) Connect the control circuit power supply and regenerative option.	Section 3.1 Section 3.3
(4)	Servo motor power output connector (CNP3) Connect the servo motor.	
(5)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(6)	Protective earth (PE) terminal Grounding terminal	Section 3.1 Section 3.3
(7)	Battery holder Install the battery for absolute position data backup.	Section 12.2

Note. Lines for slots around the battery holder are omitted from the illustration.

(4) MR-J4-500B-RJ020

POINT

●The servo amplifier is shown with the front cover open. The front cover cannot be removed.



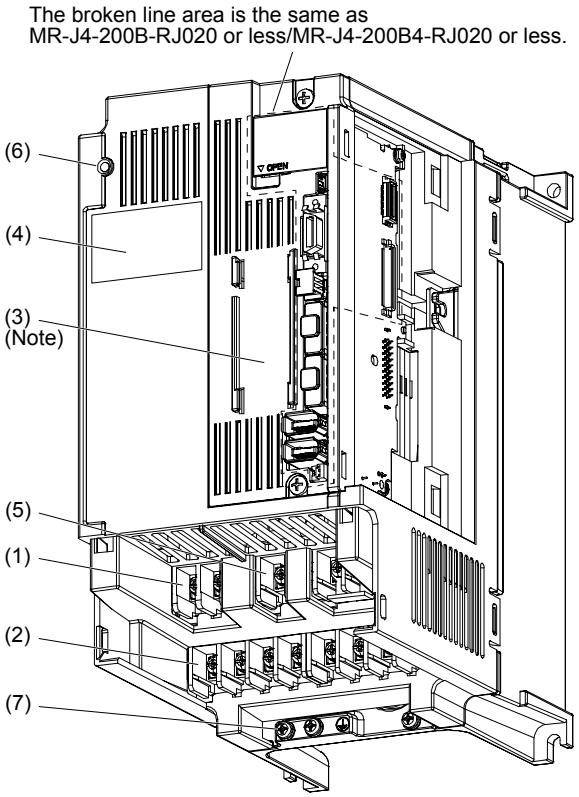
No.	Name/Application	Detailed explanation
(1)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1) Connect the input power supply.	
(3)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(4)	Rating plate	Section 1.6
(5)	Regenerative option/power factor improving reactor terminal block (TE3) Used to connect a regenerative option and a power factor improving DC reactor.	Section 3.1 Section 3.3
(6)	Servo motor power supply terminal block (TE4) Connect the servo motor.	
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(8)	Protective earth (PE) terminal Grounding terminal	Section 3.1 Section 3.3

Note. Lines for slots around the battery holder are omitted from the illustration.

(5) MR-J4-500B4-RJ020

POINT

●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.3.



No.	Name/Application	Detailed explanation
(1)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1) Used to connect the input power supply, regenerative option, and servo motor.	
(3)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(4)	Rating plate	Section 1.6
(5)	Regenerative option/power factor improving reactor terminal block (TE3) Used to connect a regenerative option and a power factor improving DC reactor.	Section 3.1 Section 3.3
(6)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	
(7)	Protective earth (PE) terminal Grounding terminal	Section 3.1 Section 3.3

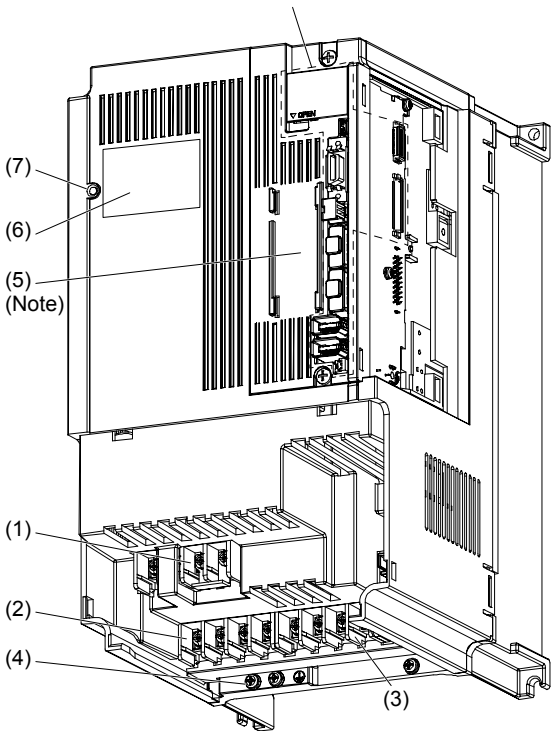
Note. Lines for slots around the battery holder are omitted from the illustration.

(6) MR-J4-700B-RJ020/MR-J4-700B4-RJ020

POINT

●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.3.

The broken line area is the same as MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less.



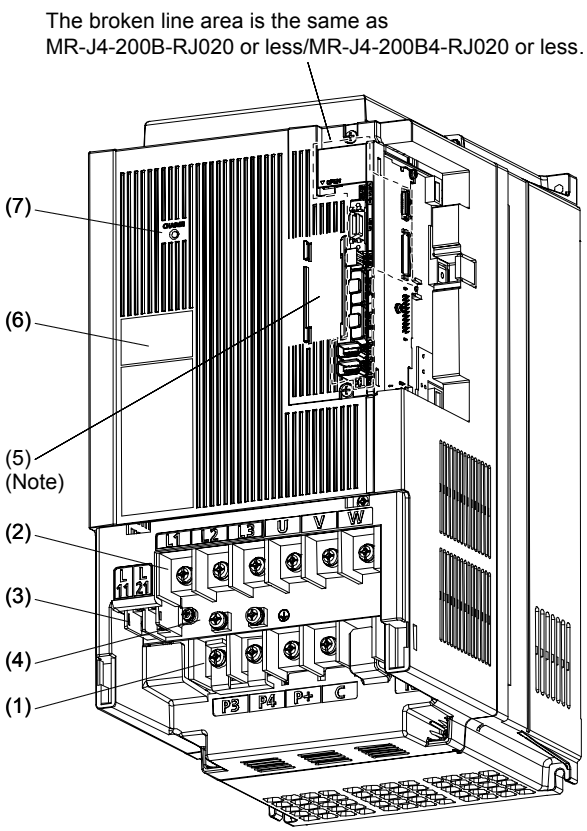
No.	Name/Application	Detailed explanation
(1)	Regenerative option/power factor improving reactor terminal block (TE3) Used to connect a regenerative option and a power factor improving DC reactor.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1) Used to connect the input power supply, regenerative option, and servo motor.	
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal Grounding terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	

Note. Lines for slots around the battery holder are omitted from the illustration.

(7) MR-J4-11KB-RJ020/MR-J4-15KB-RJ020/MR-J4-11KB4-RJ020/MR-J4-15KB4-RJ020

POINT

●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.3.



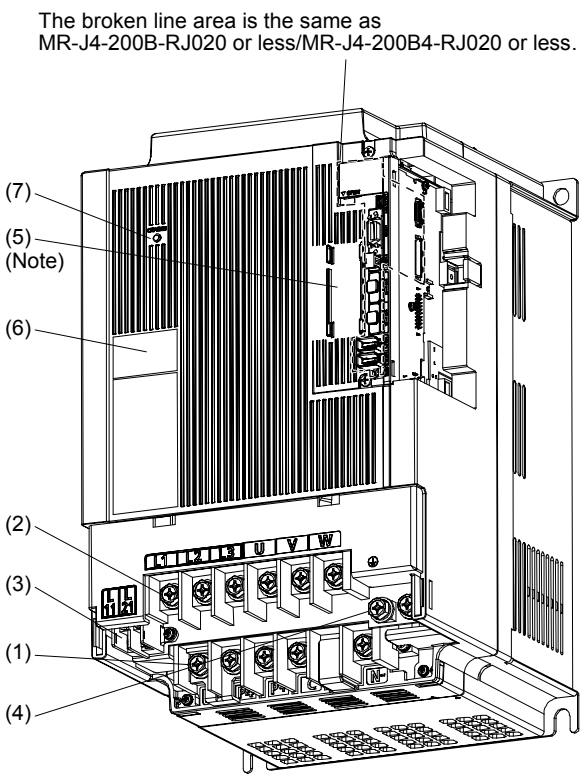
No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE1-2) Used to connect a power factor improving DC reactor and a regenerative option.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1-1) Used to connect the input power supply and servo motor.	
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal Grounding terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	

Note. Lines for slots around the battery holder are omitted from the illustration.

(8) MR-J4-22KB-RJ020/MR-J4-22KB4-RJ020

POINT

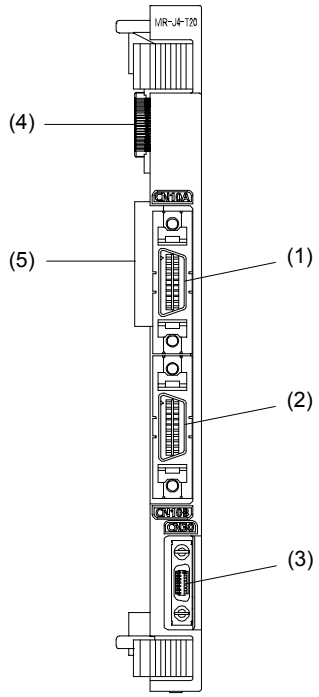
●The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.3.



No.	Name/Application	Detailed explanation
(1)	Power factor improving reactor terminal block (TE1-2) Used to connect a power factor improving DC reactor and a regenerative option.	Section 3.1 Section 3.3
(2)	Main circuit terminal block (TE1-1) Used to connect the input power supply and servo motor.	
(3)	Control circuit terminal block (TE2) Used to connect the control circuit power supply.	
(4)	Protective earth (PE) terminal Grounding terminal	
(5)	Battery holder Install the battery for absolute position data backup.	Section 12.2
(6)	Rating plate	Section 1.6
(7)	Charge lamp When the main circuit is charged, this will light up. While this lamp is lit, do not reconnect the cables.	

Note. Lines for slots around the battery holder are omitted from the illustration.

1.7.2 Parts identification of MR-J4-T20



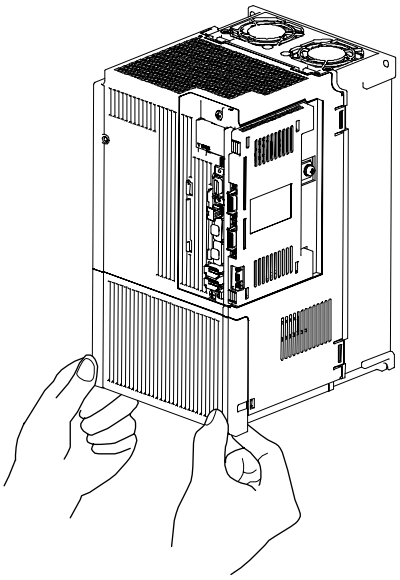
No.	Name/Application	Detailed explanation
(1)	SSCNET cable connector (CN10A) Used to connect the servo system controller or the previous axis servo amplifier.	Section 3.2 Section 11.1
(2)	SSCNET cable connector (CN10B) Used for connection with the next axis servo amplifier or for connection of the terminal connector (MR-A-TM).	
(3)	RS-232C communication connector (CN30) Connect with the personal computer.	
(4)	Optional unit connector (CN90) Connector used for connection with the CN9 connector of the servo amplifier	
(5)	Optional unit connector (CN70) Connector used for connection with the CN7 connector of the servo amplifier	

1.7.3 Removal and reinstallation of the front cover

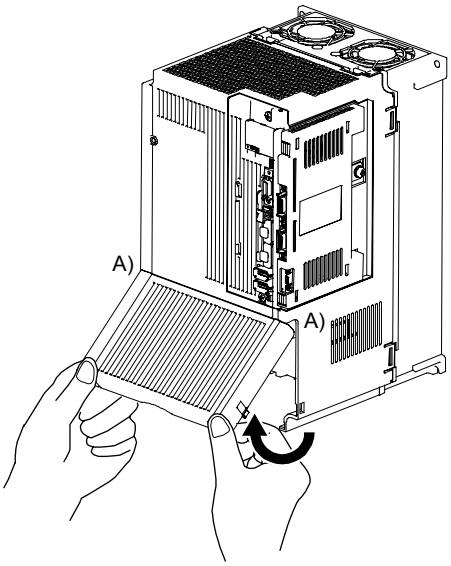
⚠CAUTION	●Before removing or installing the front cover, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

The following shows how to remove and reinstall the front cover of MR-J4-700B-RJ020 to MR-J4-22KB-RJ020 and MR-J4-500B4-RJ020 to MR-J4-22KB4-RJ020.
The diagram shows MR-J4-700B-RJ020.

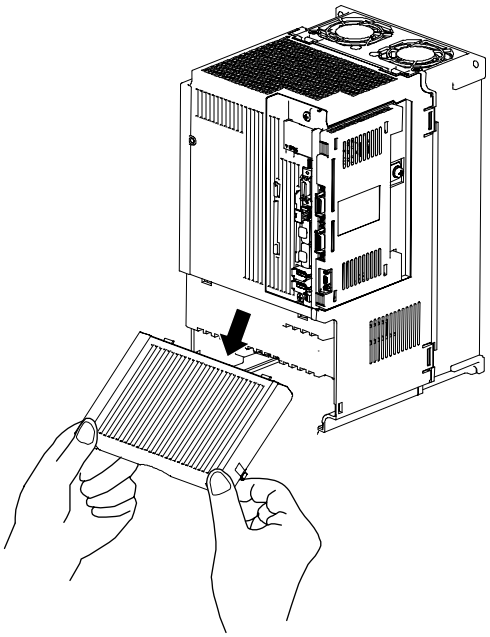
Removal of the front cover



1) Hold the ends of lower side of the front cover with both hands.

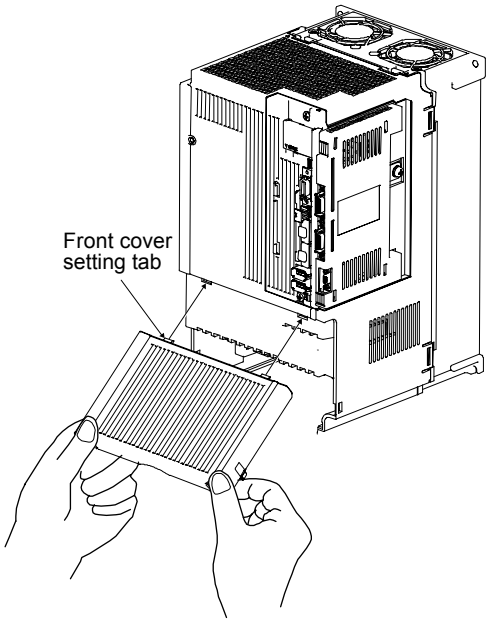


2) Pull up the cover, supporting at point A).

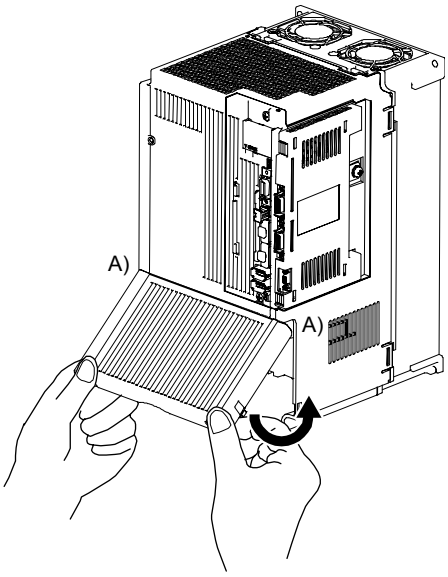


3) Pull out the front cover to remove. Hold the ends of lower side of the front cover with both hands.

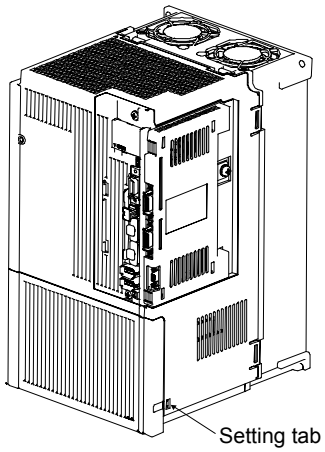
Reinstallation of the front cover



1) Insert the front cover setting tabs into the sockets of servo amplifier (2 places).



2) Push down the cover, supporting at point A).



3) Press the cover against the terminal box until the installing knobs click.

1.8 Installation and removal of MR-J4-T20

⚠WARNING

- Before installing or removing MR-J4-T20, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION

- Avoid installing and removing MR-J4-T20 repeatedly. Any contact failure of the connector may be caused.
- Avoid unsealing MR-J4-T20 to be free of dust and dirt against the connector except installing. Make sure to use the pre-packing when storing.
- Avoid using MR-J4-T20 of which the hook and knobs for fixing are damaged. Any contact failure of the connector may be caused.
- When installing and removing MR-J4-T20 to MR-J4-500B-RJ020 to MR-J4-22KB-RJ020 and MR-J4-350B4-RJ020 to MR-J4-22KB4-RJ020 servo amplifiers, avoid dropping out the installing screw inside it. Otherwise, it may cause a malfunction.
- When installing MR-J4-T20 to MR-J4-500B-RJ020 to MR-J4-22KB-RJ020 and MR-J4-350B4-RJ020 to MR-J4-22KB4-RJ020 servo amplifiers, avoid damaging the control board by the fixing plate. Otherwise, it may cause a malfunction.
- Make sure to tighten MR-J4-T20 with the enclosed installing screws when installing.

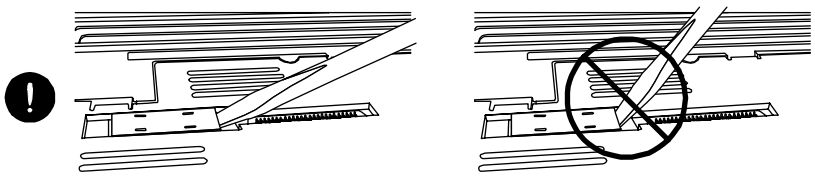
POINT

- The internal circuits of the servo amplifier and MR-J4-T20 may be damaged by static electricity. Always take the following precautions.
  - Ground human body and work bench.
  - Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

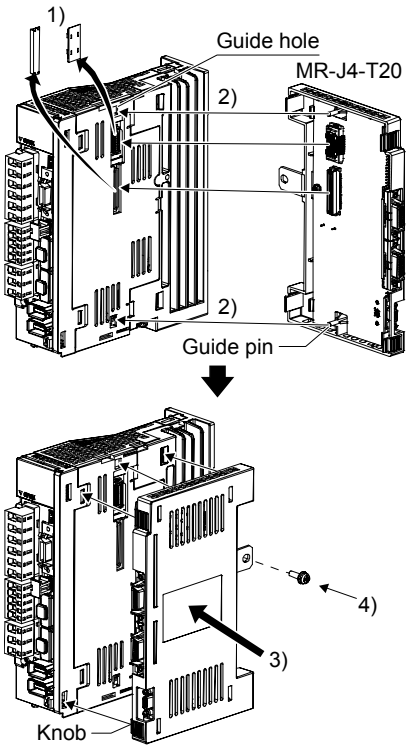
(1) For MR-J4-350B-RJ020 or less/MR-J4-200B4-RJ020 or less/MR-J4-40B1-RJ020 or less

POINT

●The cap on the CN9 connector can be removed by hand. Please do not use a tool as long as possible. When using a tool such as a screwdriver, remove caps so that the tool does not contact with boards and parts.

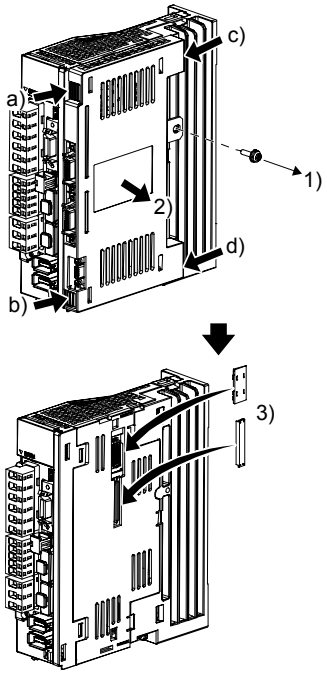


(a) Installation of MR-J4-T20



1) Remove the covers of CN7 and CN9 connectors. Make sure to store the removed cover.
2) Find the guide hole on the side of the servo amplifier. To the guide hole, insert the MR-J4-T20's guide pins.
3) Push the four corners of the side of MR-J4-T20 simultaneously to the servo amplifier until the four knobs click so that CN7 and CN9 connectors are connected straight.
4) Tighten the unit with the enclosed installing screw (M4).

(b) Removal of MR-J4-T20

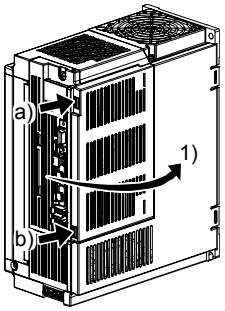


1) Remove the installing screw.
2) Keep pushing the knobs (a), b), c), d)) and pull out MR-J4-T20 to the arrow direction. Avoid pulling out MR-J4-T20 while it is tightened with the installation screw.

3) After removing MR-J4-T20, make sure to cap the CN7 and CN9 connectors to avoid dust and dirt.

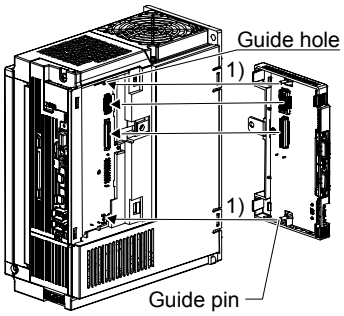
(2) For MR-J4-500B-RJ020 to MR-J4-700B-RJ020 and MR-J4-350B4-RJ020 to MR-J4-700B4-RJ020

(a) Removal of the side cover

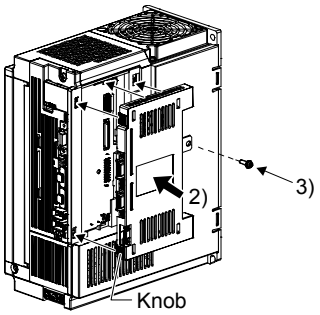


1) Keep pushing the knobs (a) , b)) and pull out the side cover to the arrow direction.

(b) Installation of MR-J4-T20

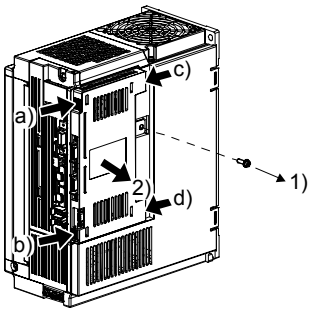


1) Find the guide hole on the side of the servo amplifier. To the guide hole, insert the MR-J4-T20's guide pins.



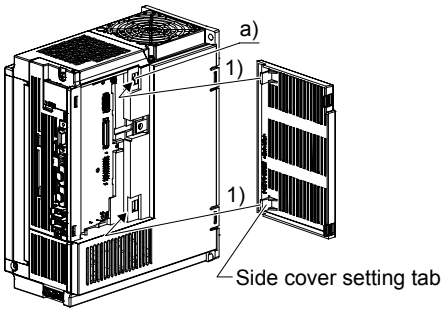
2) Push the four corners of the side of MR-J4-T20 simultaneously to the servo amplifier until the four knobs click so that CN7 and CN9 connectors are connected straight.
3) Tighten the unit with the enclosed installing screw (M4).

(c) Removal of MR-J4-T20

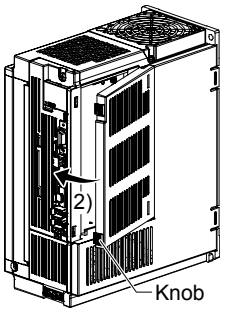


1) Remove the installing screw.
2) Keep pushing the knobs (a), b), c), d)) and pull out MR-J4-T20 to the arrow direction. Avoid pulling out MR-J4-T20 while it is tightened with the installation screw.

(d) Installation of the side cover



1) Insert the side cover setting tabs into the sockets a) of servo amplifier.

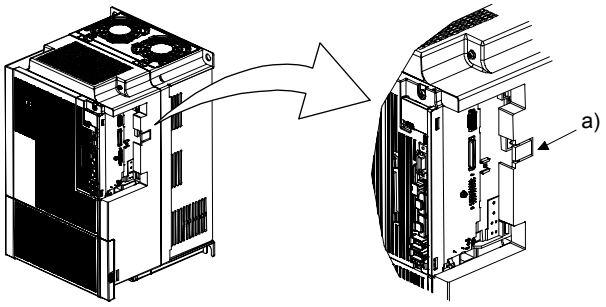


2) Push the side cover at the supporting point a) until the knobs click.

(3) For MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020

⚠CAUTION ●Avoid touching any remained burr after cutting off the part a) of the case. Otherwise, it may cause injury.

The installing screw holes for the MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020 servo amplifiers are covered and not shown at shipping. When installing the unit for the first time, cut off the part a) of the case after removing the side cover.
When cutting off the part a), avoid damaging the case of the servo amplifier. After cutting off it, inside of the servo amplifier has been exposed even though the side cover and the unit are installed. Avoid unwanted parts from entering through the opened area into the servo amplifier.
For installing or removing the unit, refer to (2) in this section. The side cover structure is the same for MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020 and for this unit. Install or remove the side cover with the same way as for the unit.



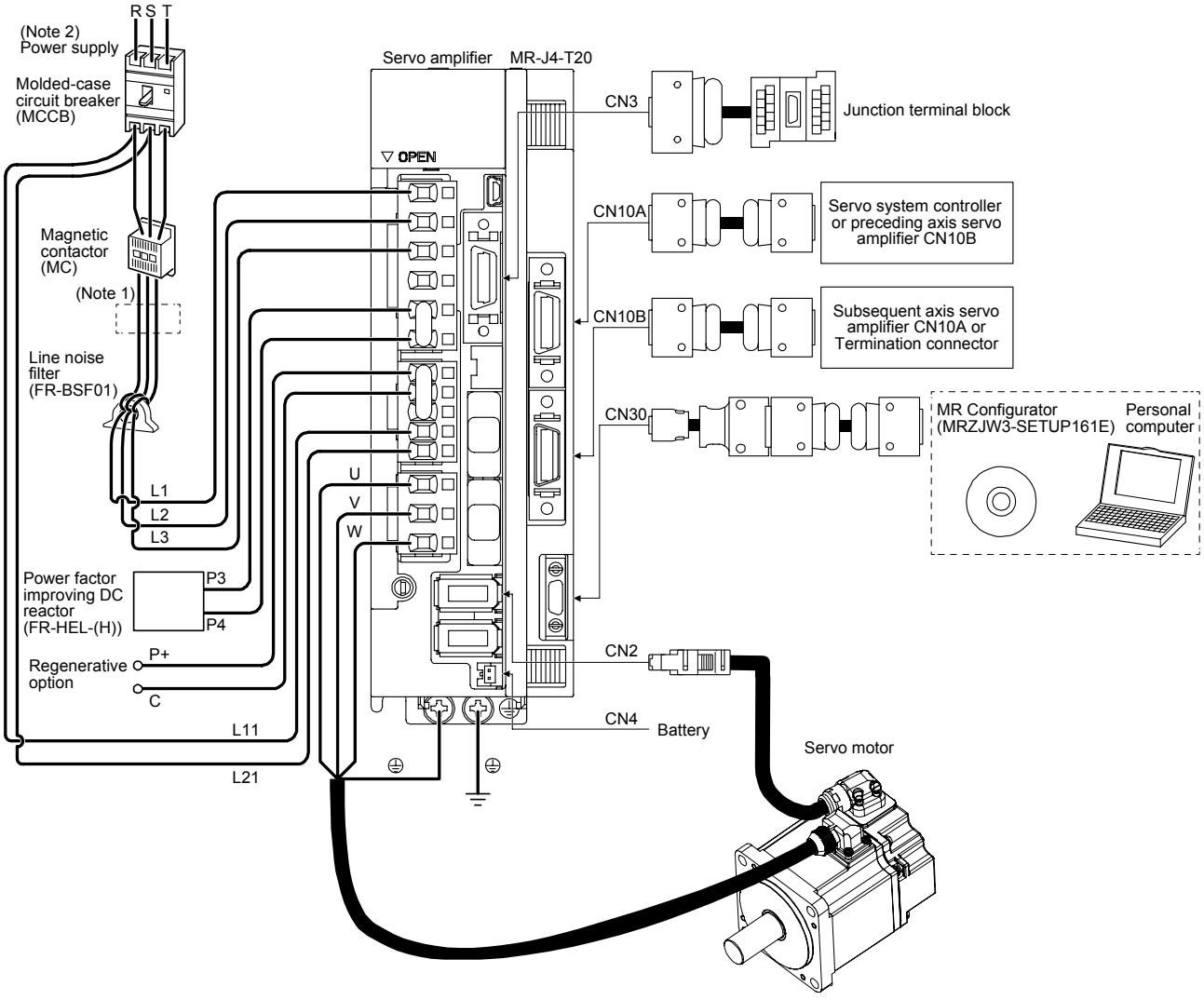
1.9 Configuration including peripheral equipment

⚠CAUTION ●Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

POINT

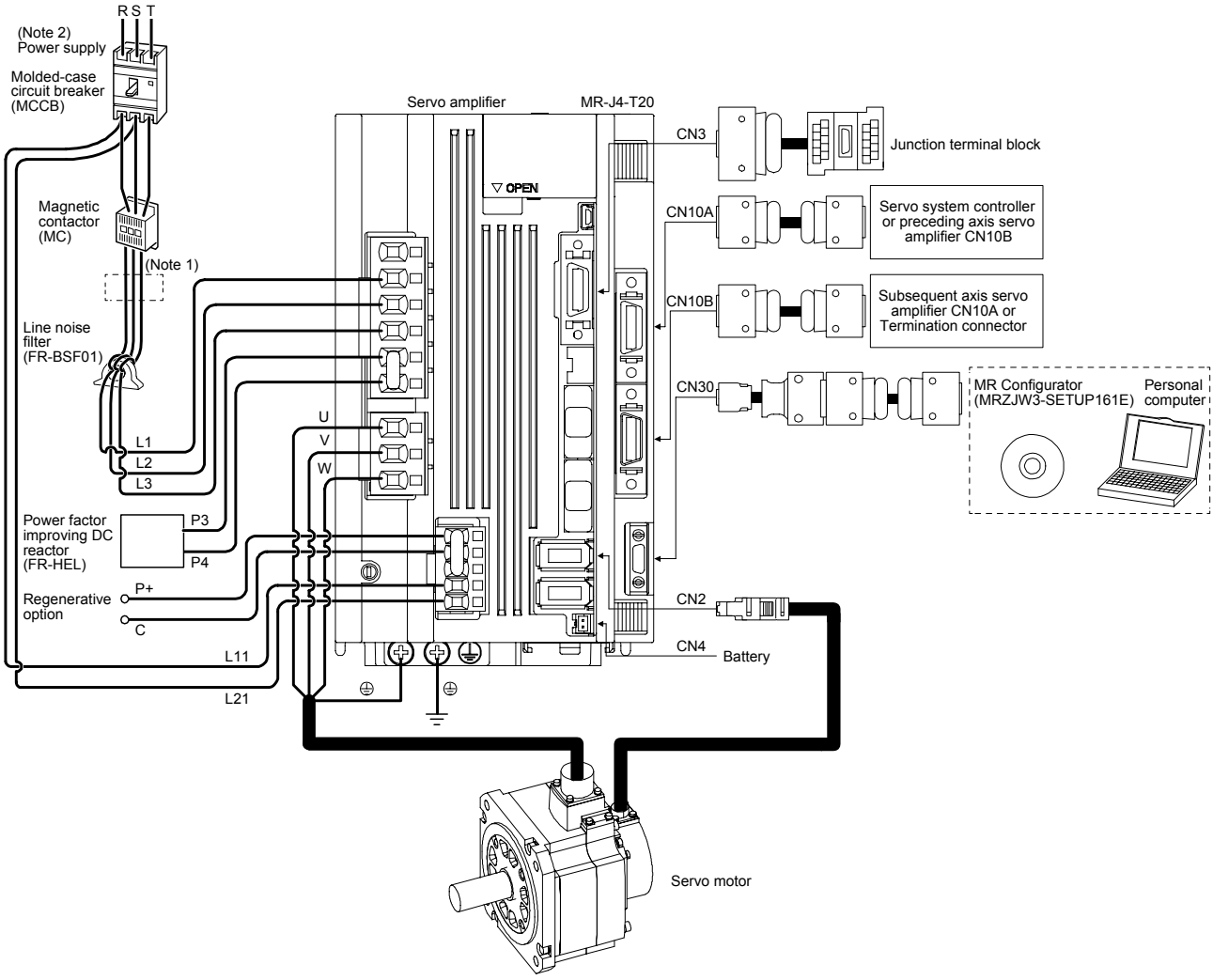
●Equipment other than the servo amplifier and servo motor are optional or recommended products.

(1) MR-J4-200B-RJ020 or less/MR-J4-200B4-RJ020 or less
The diagram shows MR-J4-10B-RJ020.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.
2. A 1-phase 200 V AC to 240 V AC power supply may be used with the servo amplifier of MR-J4-70B-RJ020 or less. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open. For power supply specifications, refer to section 1.3.1.

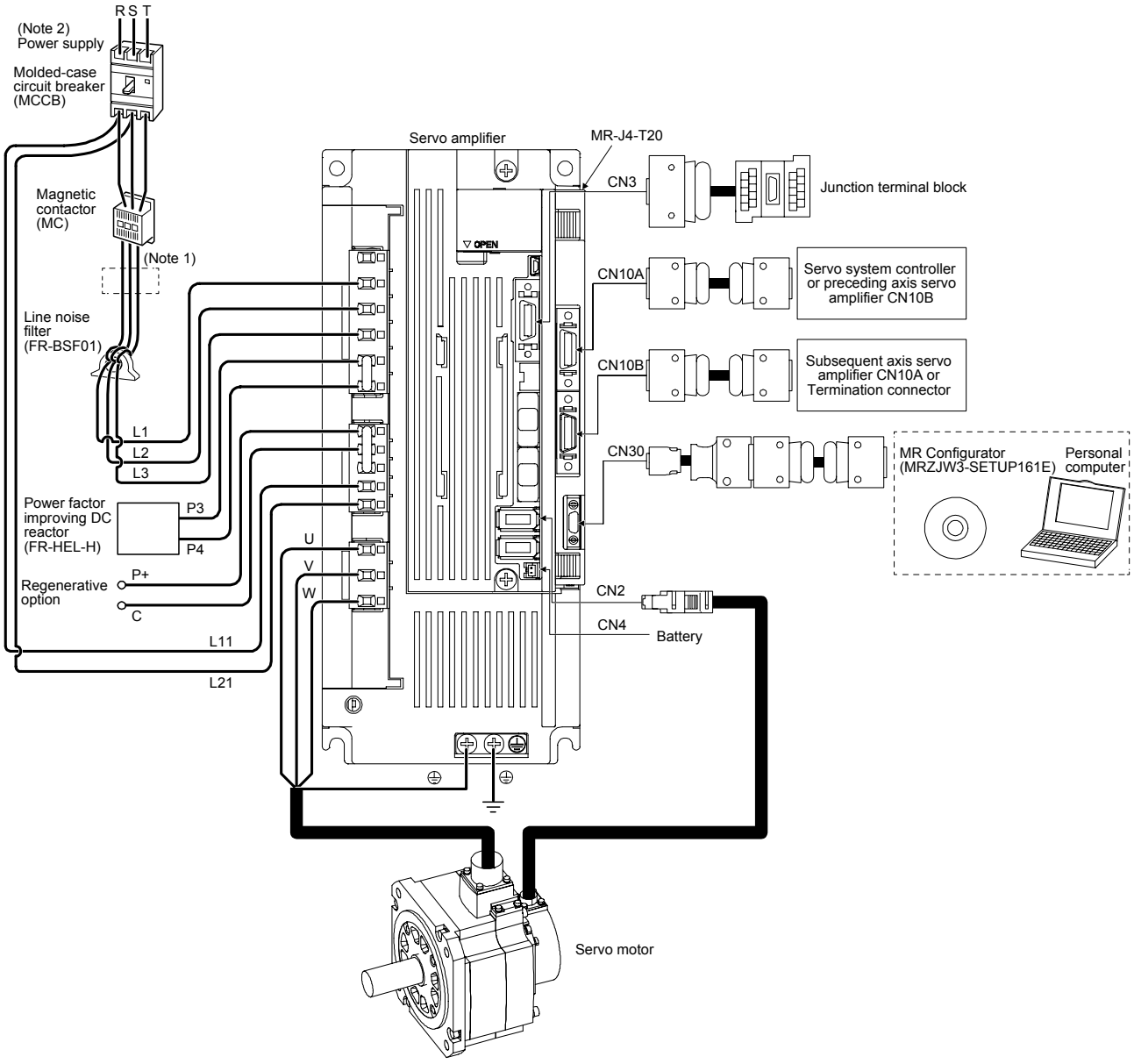
(2) MR-J4-350B-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

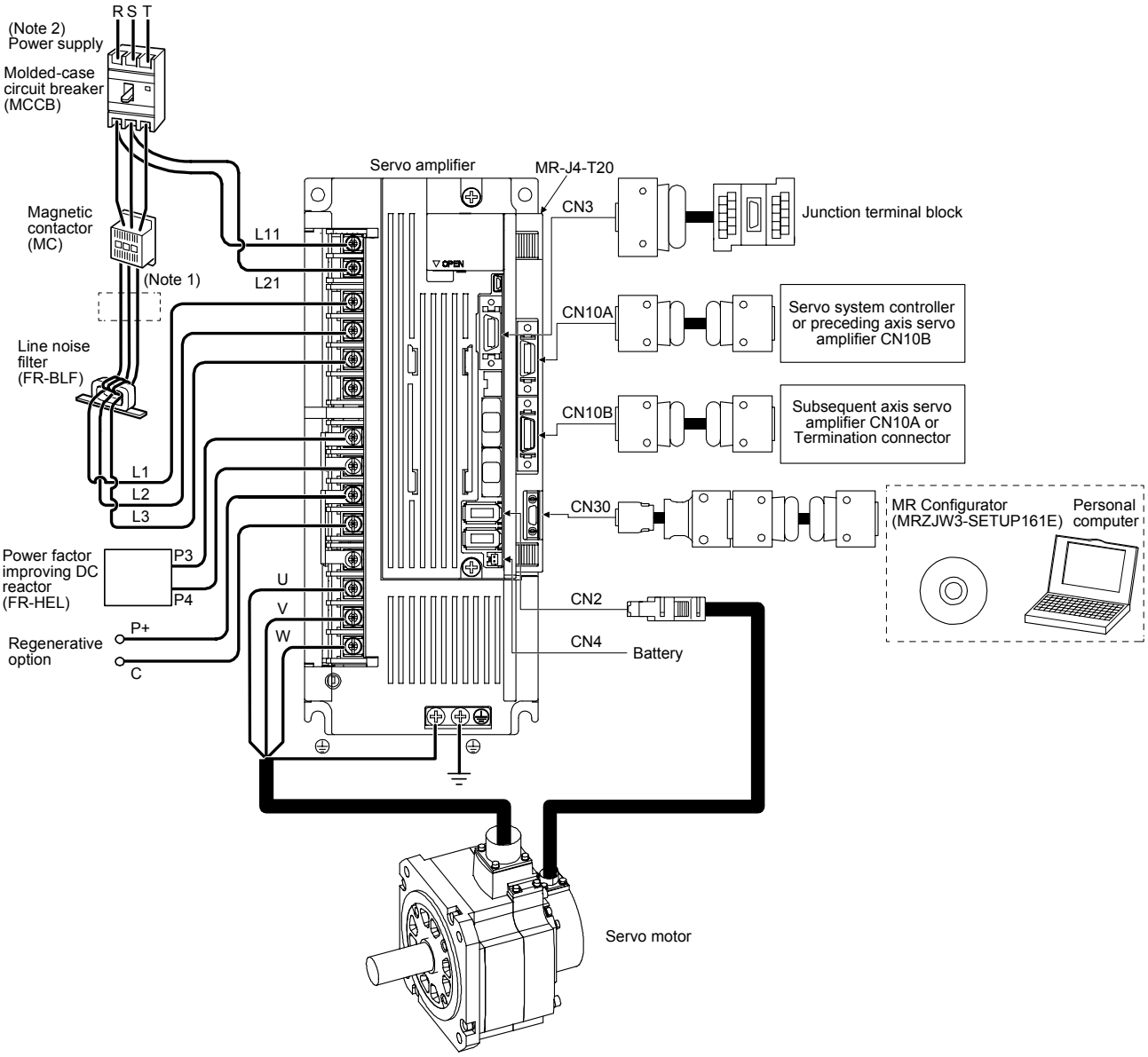
(3) MR-J4-350B4-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

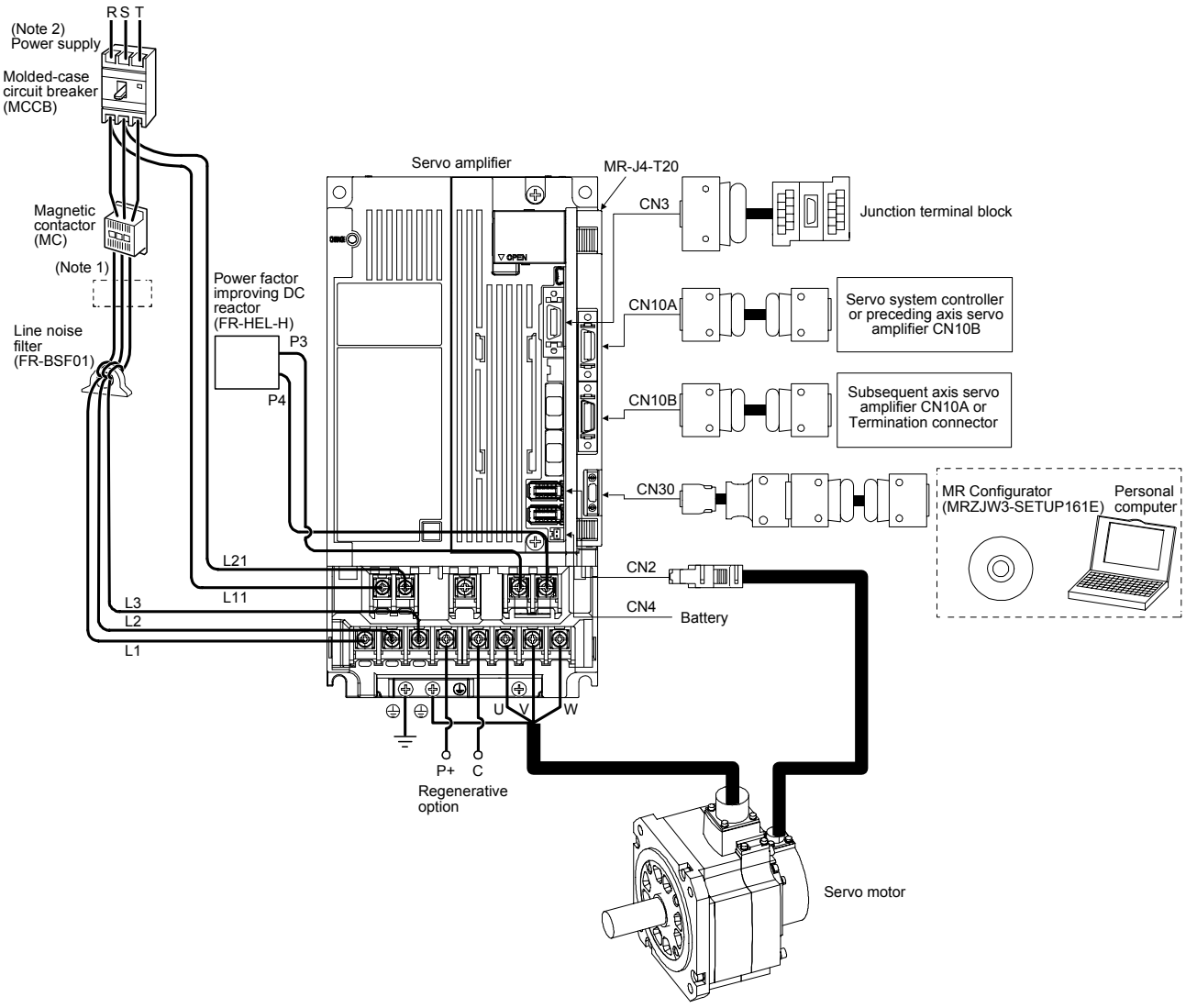
(4) MR-J4-500B-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

(5) MR-J4-500B4-RJ020

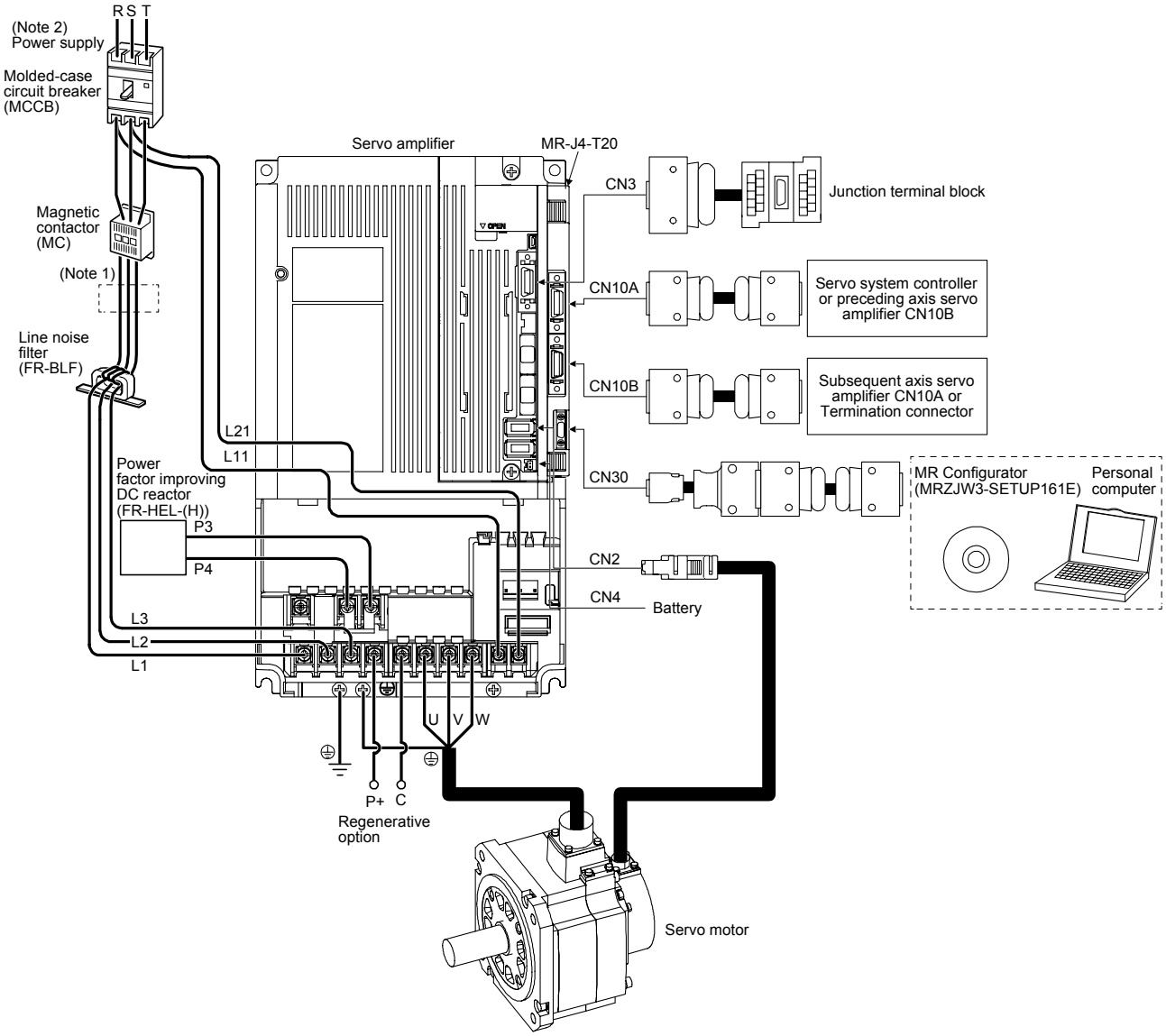


Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

(6) MR-J4-700B-RJ020/MR-J4-700B4-RJ020

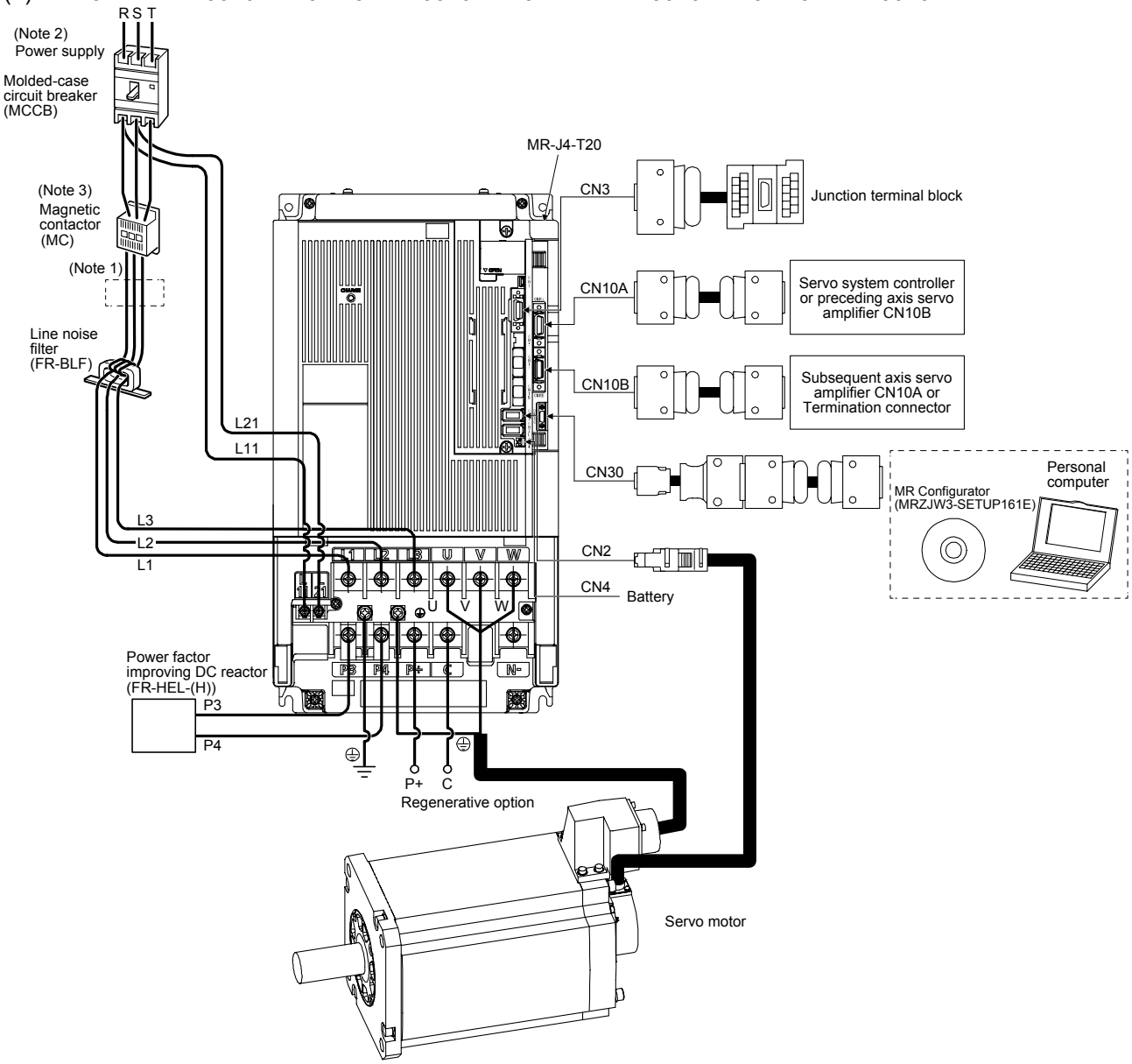
The diagram shows MR-J4-700B-RJ020.



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

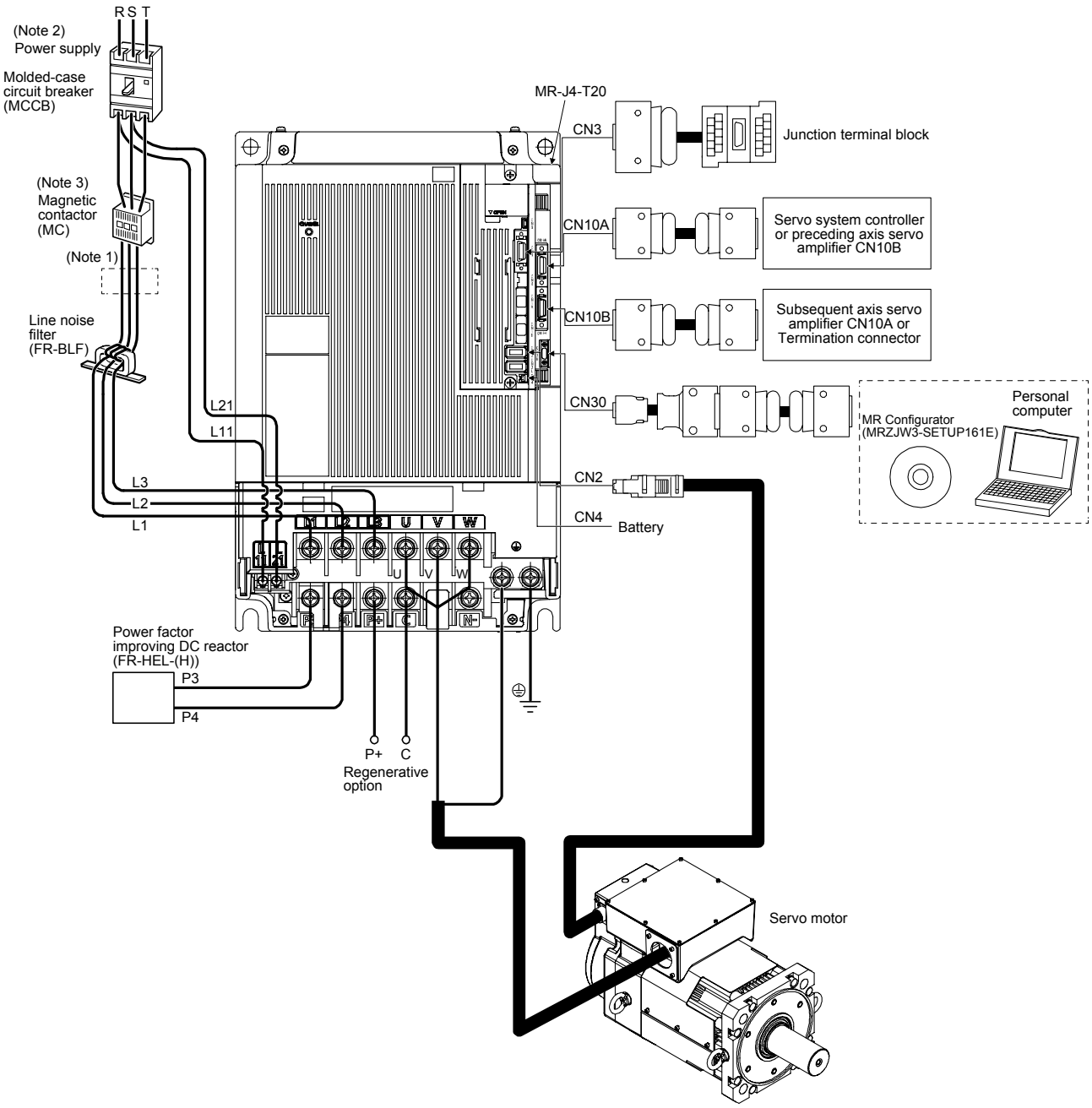
(7) MR-J4-11KB-RJ020/MR-J4-15KB-RJ020/MR-J4-11KB4-RJ020/MR-J4-15KB4-RJ020



Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

(8) MR-J4-22KB-RJ020/MR-J4-22KB4-RJ020

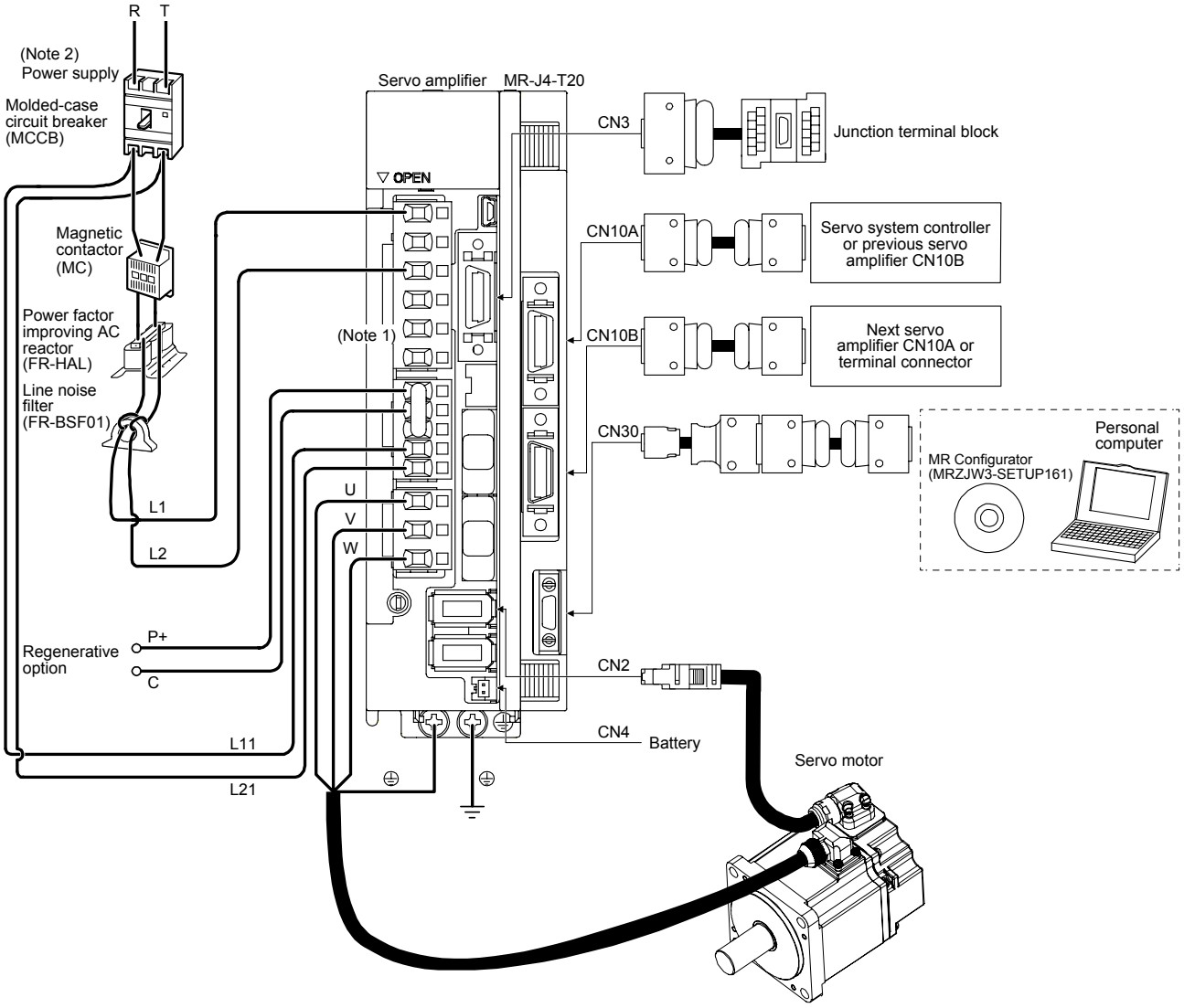


Note 1. The power factor improving AC reactor can also be used. In this case, the power factor improving DC reactor cannot be used. When not using the power factor improving DC reactor, short P3 and P4.

2. For power supply specifications, refer to section 1.3.1.

(9) MR-J4-10B1-RJ020/MR-J4-20B1-RJ020/MR-J4-40B1-RJ020

The diagram shows MR-J4-10B1-RJ020.



Note 1. The power factor improving DC reactor cannot be used.

2. For power supply specifications, refer to section 1.3.1.

2. INSTALLATION

⚠WARNING ●To prevent electric shock, ground each equipment securely.

⚠CAUTION

●Stacking in excess of the specified number of product packages is not allowed.
●Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to a fire.
●Install the servo amplifier and the servo motor in a load-bearing place in accordance with the Instruction Manual.
●Do not get on or put heavy load on the equipment. Otherwise, it may cause injury.
●Use the equipment within the specified environment. For the environment, refer to section 1.3.
●Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the servo amplifier and MR-J4-T20.
●Do not block the intake and exhaust areas of the servo amplifier and MR-J4-T20. Otherwise, it may cause a malfunction.
●Do not drop or strike the servo amplifier and MR-J4-T20. Isolate them from all impact loads.
●Do not install or operate the servo amplifier and MR-J4-T20 which have been damaged or have any parts missing.
●When the product has been stored for an extended period of time, contact your local sales office.
●When handling the servo amplifier and MR-J4-T20, be careful about the edged parts such as corners of them.
●The servo amplifier and MR-J4-T20 must be installed in a metal cabinet.
●When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products.
Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method).
Additionally, disinfect and protect wood from insects before packing products.

POINT

●When pulling out CNP1, CNP2, and CNP3 connectors of 100 V class and 600 W or less of 200 V class servo amplifiers, pull out CN3 and CN8 connectors beforehand.

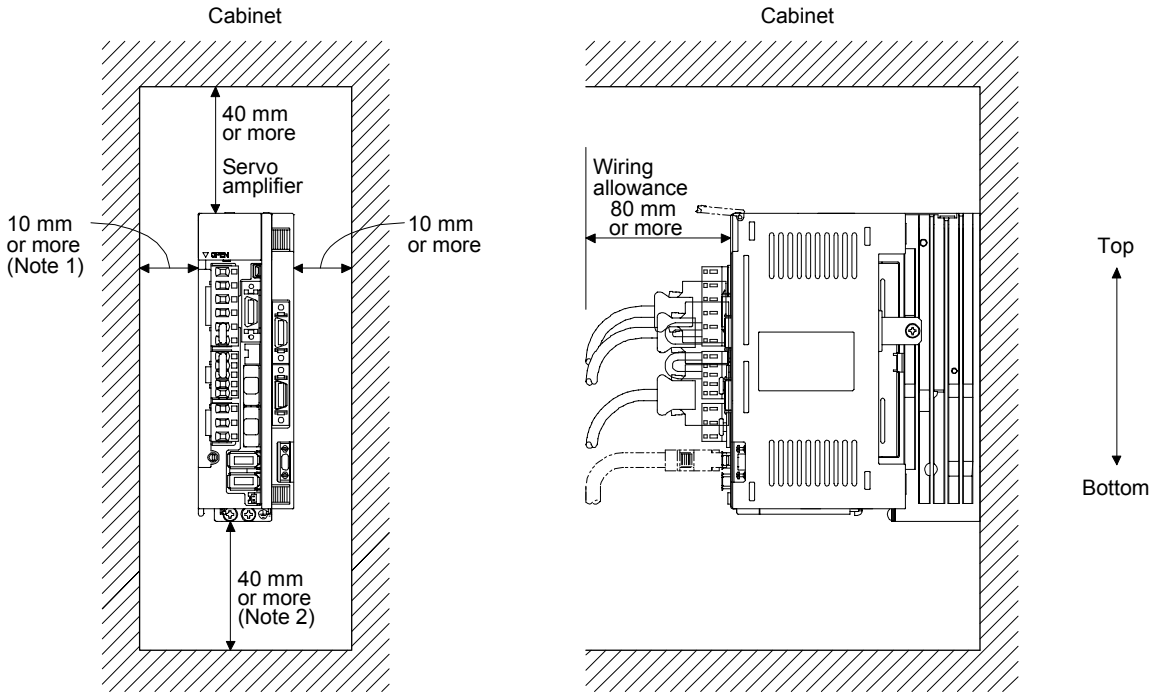
2. INSTALLATION

2.1 Installation direction and clearances

⚠CAUTION	●The equipment must be installed in the specified direction. Otherwise, it may cause a malfunction. ●Leave specified clearances between the servo amplifier/MR-J4-T20 and the cabinet walls or other equipment. Otherwise, it may cause a malfunction.

(1) Installation clearances of the servo amplifier

(a) Installation of one servo amplifier



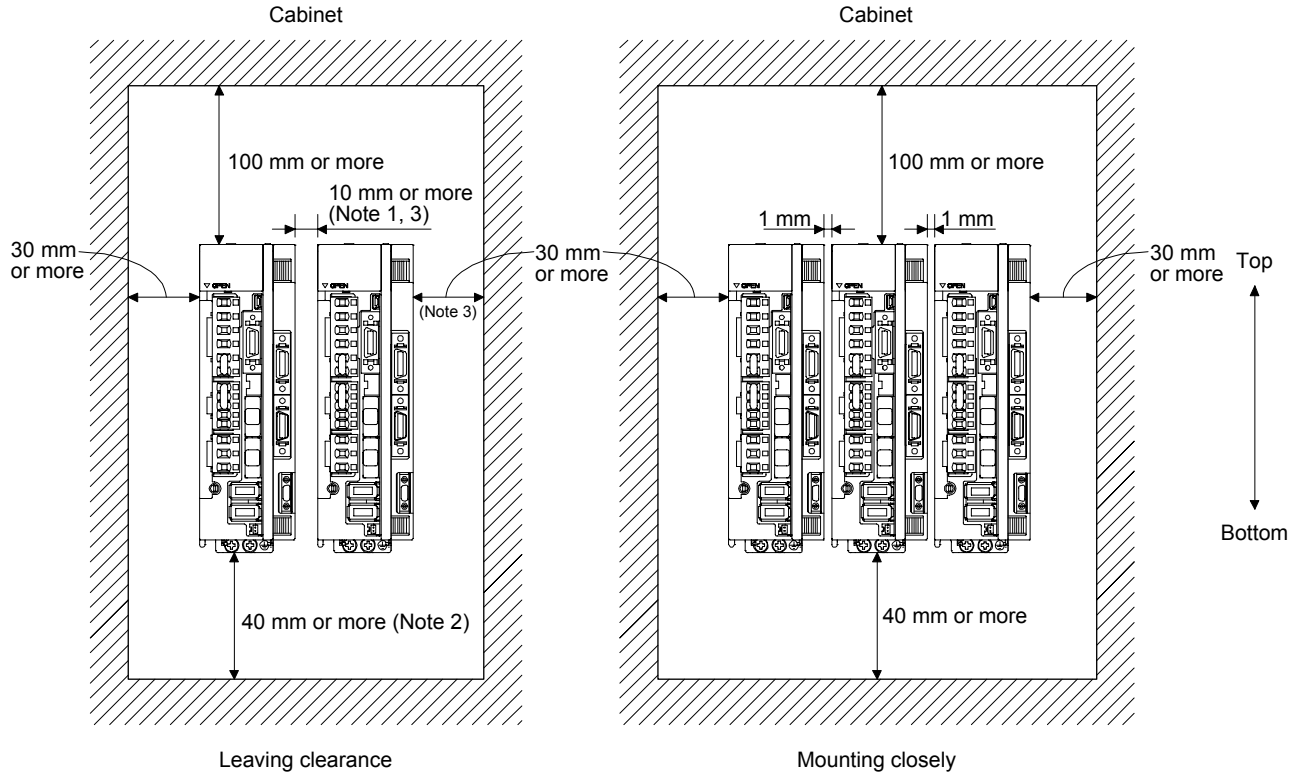
Note 1. For the MR-J4-500B-RJ020 servo amplifier, the clearance between the left side and wall will be 25 mm or more.

2. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.

(b) Installation of two or more servo amplifiers

POINT
●Close mounting is possible depending on the capacity of the servo amplifier. Refer to section 1.3 for availability of close mounting. ●When mounting the servo amplifiers closely, do not install the servo amplifier whose depth is larger than that of the left side servo amplifier since CNP1, CNP2, and CNP3 connectors cannot be disconnected.

Leave a large clearance between the top of the servo amplifier and the cabinet walls, and install a cooling fan to prevent the internal temperature of the cabinet from exceeding the environment. When mounting the servo amplifiers closely, leave a clearance of 1 mm between the adjacent servo amplifiers in consideration of mounting tolerances. In this case, keep the ambient temperature within 0 ˚C to 45 ˚C or use the servo amplifier with 75% or less of the effective load ratio.



Note 1. When you install the MR-J4-500B-RJ020 servo amplifier on the right side, the clearance between the left side and the wall will be 25 mm or more.
2. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.
3. A clearance for mounting can be smaller for the following servo amplifiers.

Servo amplifier	Clearance for the right-side servo amplifier [mm] (recommended clearance: 10 mm or more)	Clearance for the right-side cabinet wall [mm] (recommended clearance: 30 mm or more)
MR-J4-10B-RJ020/MR-J4-20B-RJ020 MR-J4-70B-RJ020/MR-J4-100B-RJ020 MR-J4-10B1-RJ020/MR-J4-20B1-RJ020	8	28
MR-J4-200B-RJ020/MR-J4-350B-RJ020 MR-J4-200B4-RJ020	3	23
MR-J4-500B4-RJ020	8	28

(2) Others
When using heat generating equipment such as the regenerative option, install them with full consideration of heat generation so that the servo amplifier is not affected.
Install the servo amplifier on a perpendicular wall in the correct vertical direction.

2.2 Keep out foreign materials

(1) When drilling in the cabinet, prevent drill chips and wire fragments from entering the servo amplifier.

(2) Prevent oil, water, metallic dust, etc. from entering the servo amplifier through openings in the cabinet or a cooling fan installed on the ceiling.

(3) When installing the cabinet in a place where toxic gas, dirt and dust exist, conduct an air purge (force clean air into the cabinet from outside to make the internal pressure higher than the external pressure) to prevent such materials from entering the cabinet.

2.3 Encoder cable stress

(1) The way of clamping the cable must be fully examined so that bending stress and cable's own weight stress are not applied to the cable connection.

(2) For use in any application where the servo motor moves, fix the cables (encoder, power supply, and brake) with having some slack from the connector connection part of the servo motor to avoid putting stress on the connector connection part. Use the optional encoder cable within the bending life range. Use the power supply and brake wiring cables within the bending life of the cables.

(3) Avoid any probability that the cable sheath might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.

(4) For installation on a machine where the servo motor moves, the flexing radius should be made as large as possible. Refer to section 10.4 for the bending life.

2.4 Inspection items

⚠WARNING	●Before starting maintenance and/or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier. ●To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

⚠CAUTION	●Do not perform insulation resistance test on the servo amplifier. Otherwise, it may cause a malfunction. ●Do not disassemble and/or repair the equipment on customer side.

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws.

(2) Check the cables and the like for scratches or cracks. Inspect them periodically according to operating conditions especially when the servo motor is movable.

(3) Check that the connector is securely connected to the servo amplifier and MR-J4-T20.

(4) Check that the wires are not coming out from the connector.

(5) Check for dust accumulation on the servo amplifier and MR-J4-T20.

(6) Check for unusual noise generated from the servo amplifier and MR-J4-T20.

2.5 Parts having service lives

Service lives of the following parts are listed below. However, the service life vary depending or operating methods and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service lives. For parts replacement, please contact your local sales office.

Part name	Life guideline
Smoothing capacitor	10 years
Relay	Number of power-on, forced stop by EM1 (Forced stop), and controller forced stop times: 100,000 times Number of on and off for STO: 1,000,000 times
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 years)
Absolute position battery	Refer to section 12.2.

(1) Smoothing capacitor

The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment (40 ˚C surrounding air temperature or less).

(2) Relays

Contact faults will occur due to contact wear arisen from switching currents. Relays reach the end of their lives when the power has been turned on, forced stop by EM1 (Forced stop) has occurred, and controller forced stop has occurred 100,000 times in total, or when the STO has been turned on and off 1,000,000 times while the servo motor is stopped under servo-off state. However, the lives of relays may depend on the power supply capacity.

(3) Servo amplifier cooling fan

The cooling fan bearings reach the end of their life in 10,000 hours to 30,000 hours. Normally, therefore, the cooling fan must be replaced in a few years of continuous operation as a guideline. It must also be changed if unusual noise or vibration is found during inspection.

The life indicates under the yearly average ambient temperature of 40 ˚C, free from corrosive gas, flammable gas, oil mist, dust and dirt.

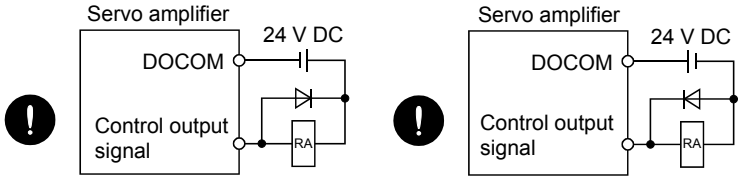
3. SIGNALS AND WIRING

⚠WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.
- Ground the servo amplifier and servo motor securely.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, it may cause an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, it may cause an electric shock.
- To avoid an electric shock, insulate the connections of the power supply terminals.

⚠CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
- Connect cables to the correct terminals. Otherwise, a burst, damage, etc. may occur.
- Ensure that polarity (+/-) is correct. Otherwise, a burst, damage, etc. may occur.
- The surge absorbing diode installed to the DC relay for control output should be fitted in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.

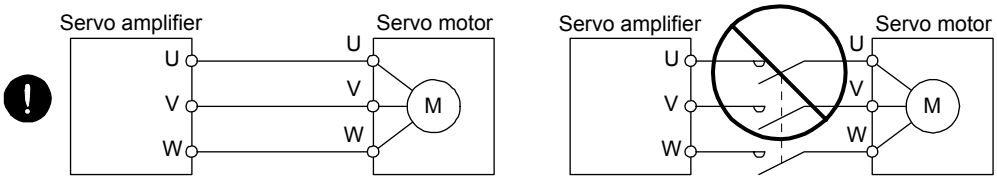


For sink output interface　　For source output interface

- Use a noise filter, etc. to minimize the influence of electromagnetic interference. Electromagnetic interference may be given to the electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge killer or radio noise filter (optional FR-BIF-(H)) with the power line of the servo motor.
- When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
- Do not modify the equipment.
- Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

⚠CAUTION

●Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.



3.1 Input power supply circuit

⚠CAUTION

●Always connect a magnetic contactor between the power supply and the main circuit power supply (L1, L2, and L3) of the servo amplifier, in order to configure a circuit that shuts down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.

●Switch main circuit power supply off at detection of an alarm. Not doing so may cause a fire when a regenerative transistor malfunctions or the like may overheat the regenerative resistor.

●Check the servo amplifier model, and then input proper voltage to the servo amplifier power supply. If input voltage exceeds the upper limit of the specification, the servo amplifier will break down.

●The servo amplifier has a built-in surge absorber (varistor) to reduce noise and to suppress lightning surge. The varistor can break down due to its aged deterioration. To prevent a fire, use a molded-case circuit breaker or fuse for input power supply.

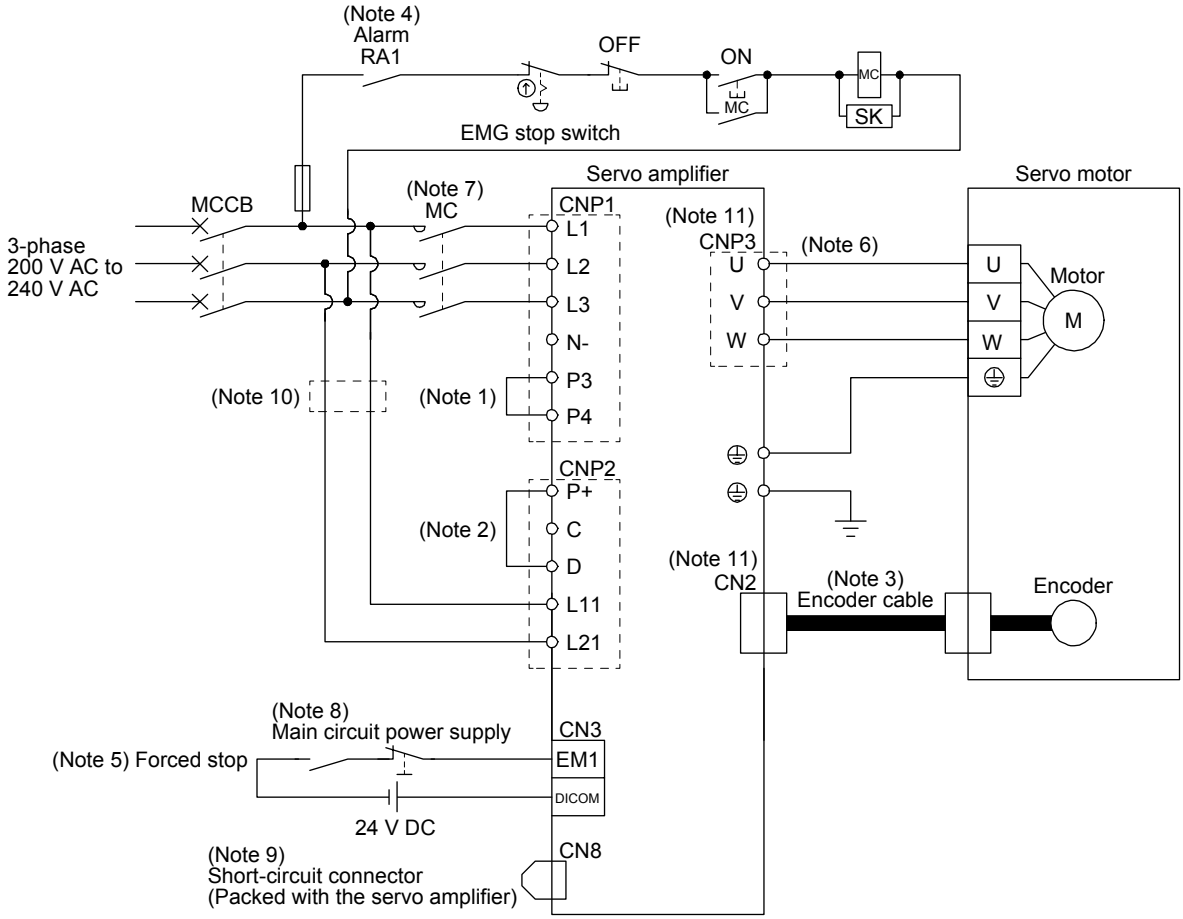
●Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

POINT

●Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L3. One of the connecting destinations is different from MR-J2S series servo amplifier's. When using MR-J4 as a replacement for MR-J2S, be careful not to connect the power to L2.

Configure the wiring to shut off the main circuit power supply and turn off the servo-on command as soon as an alarm occurs, or the servo forced stop or controller forced stop is enabled. A molded-case circuit breaker (MCCB) must be used with the input cables of the main circuit power supply.

(1) For 3-phase 200 V AC to 240 V AC power supply of MR-J4-10B-RJ020 to MR-J4-350B-RJ020



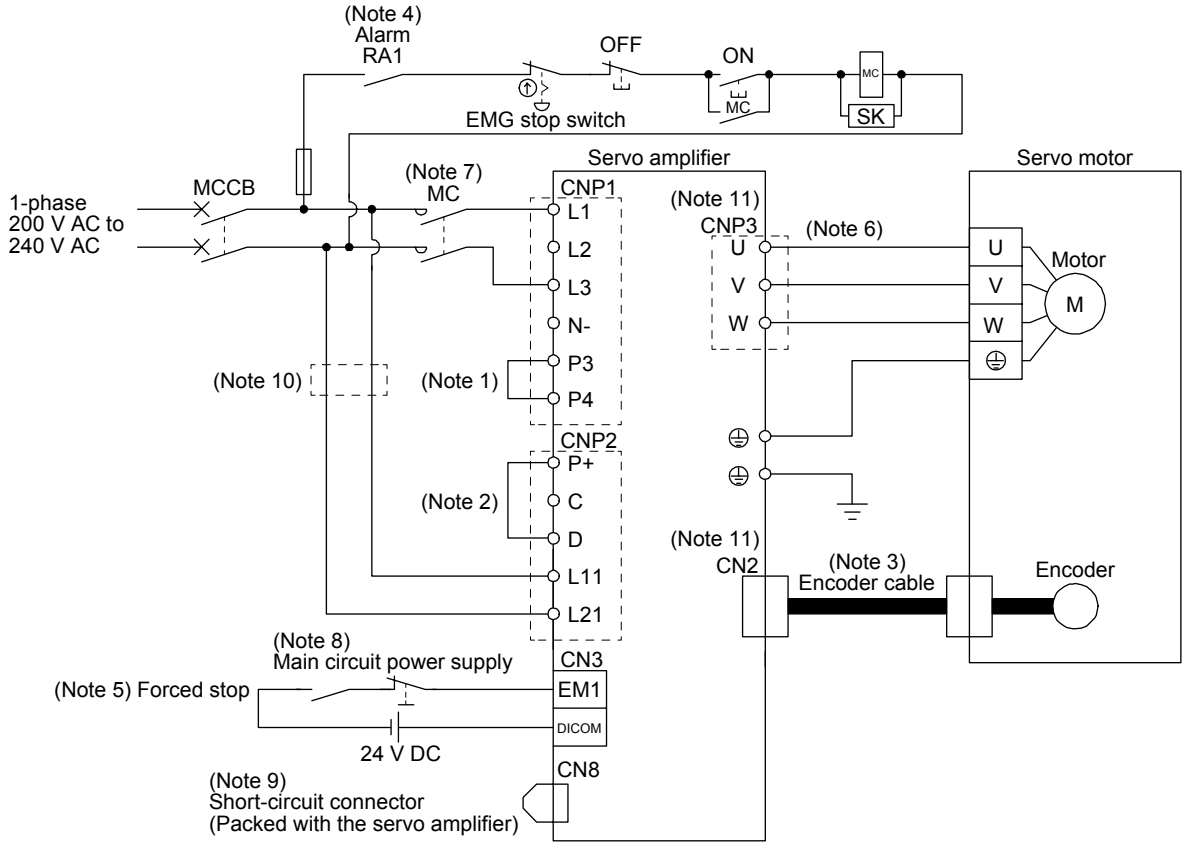
Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

(2) For 1-phase 200 V AC to 240 V AC power supply of MR-J4-10B-RJ020 to MR-J4-70B-RJ020

POINT

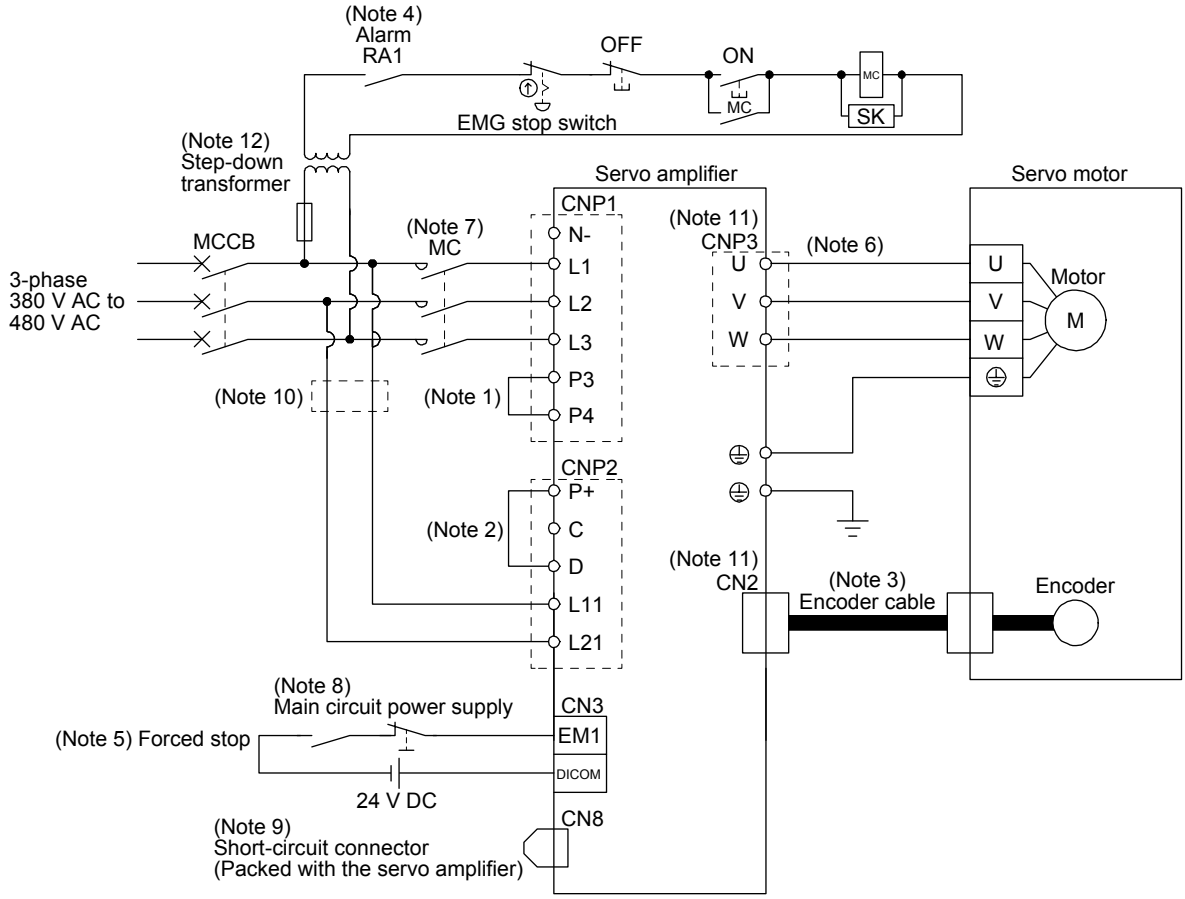
●Connect the 1-phase 200 V AC to 240 V AC power supply to L1 and L3. One of the connecting destinations is different from MR-J2S series servo amplifier's. When using MR-J4 as a replacement for MR-J2S, be careful not to connect the power to L2.



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

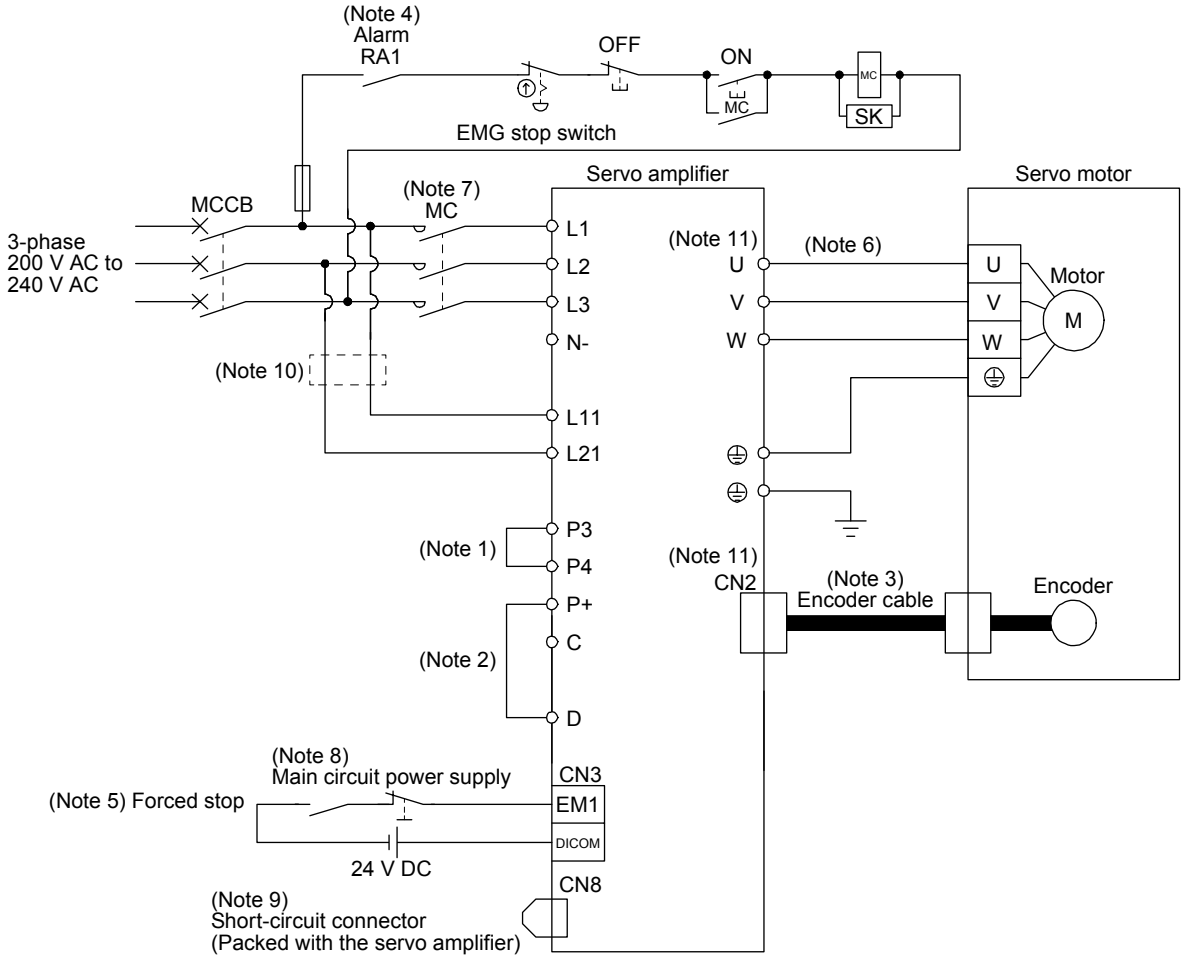
(3) MR-J4-60B4-RJ020 to MR-J4-350B4-RJ020



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
12. Step-down transformer is required when the coil voltage of the magnetic contactor is 200 V class.

(4) MR-J4-500B-RJ020



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.

3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".

4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.

6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".

7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.

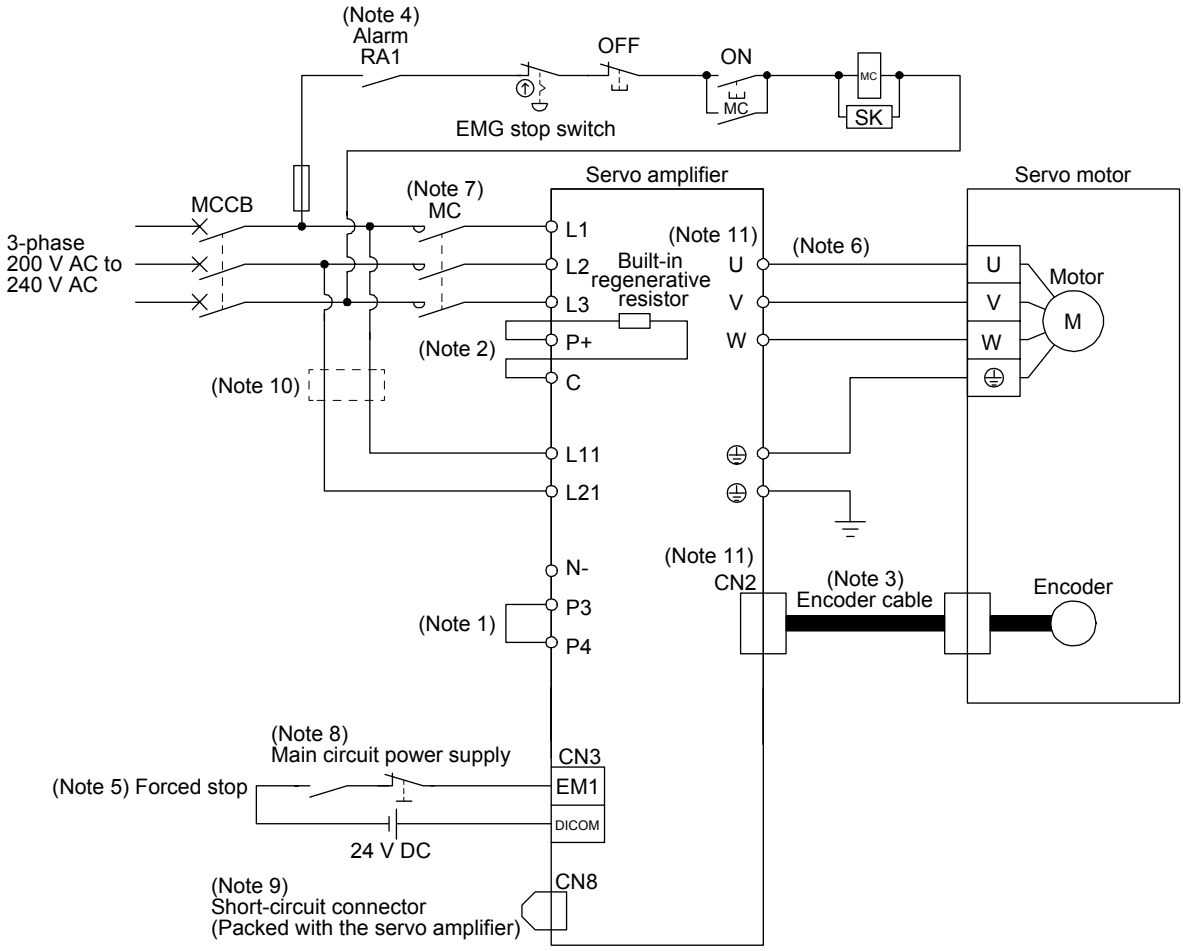
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.

9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.

10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)

11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

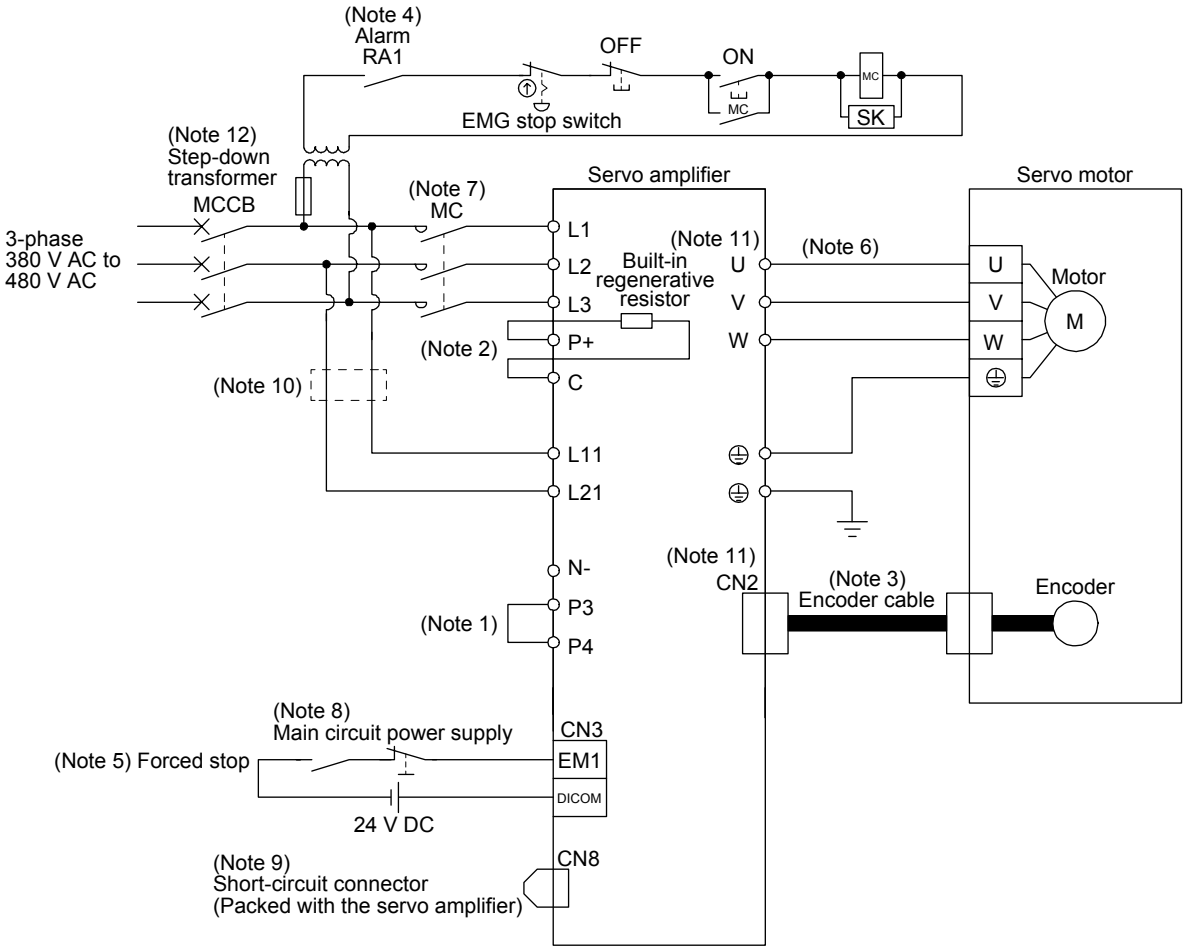
(5) MR-J4-700B-RJ020



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

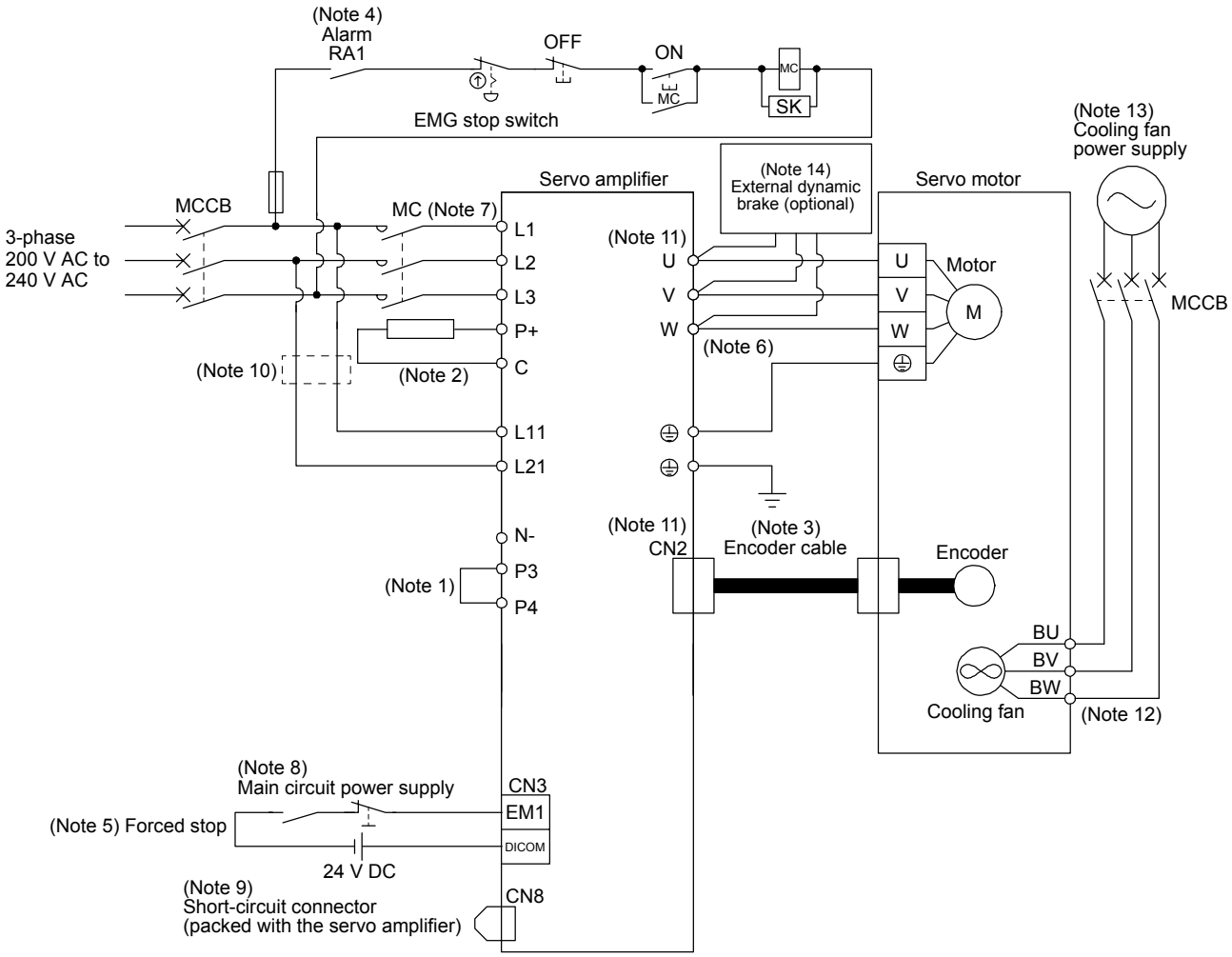
(6) MR-J4-500B4-RJ020/MR-J4-700B4-RJ020



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the incorrect axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
12. Step-down transformer is required when the coil voltage of the magnetic contactor is 200 V class.

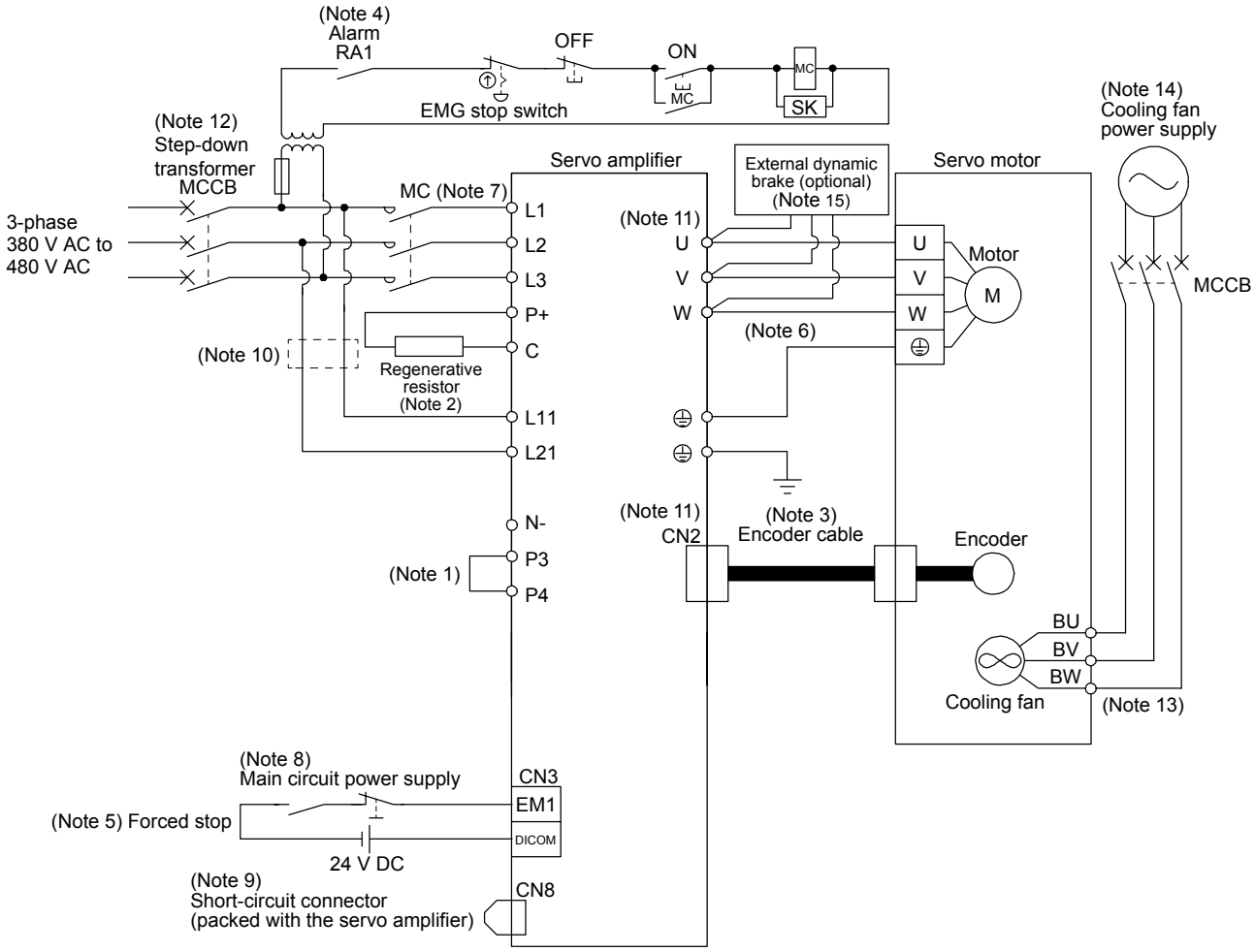
(7) MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
12. Only HG-JP22K1M servo motor is equipped with a cooling fan.
13. For the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
14. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment.

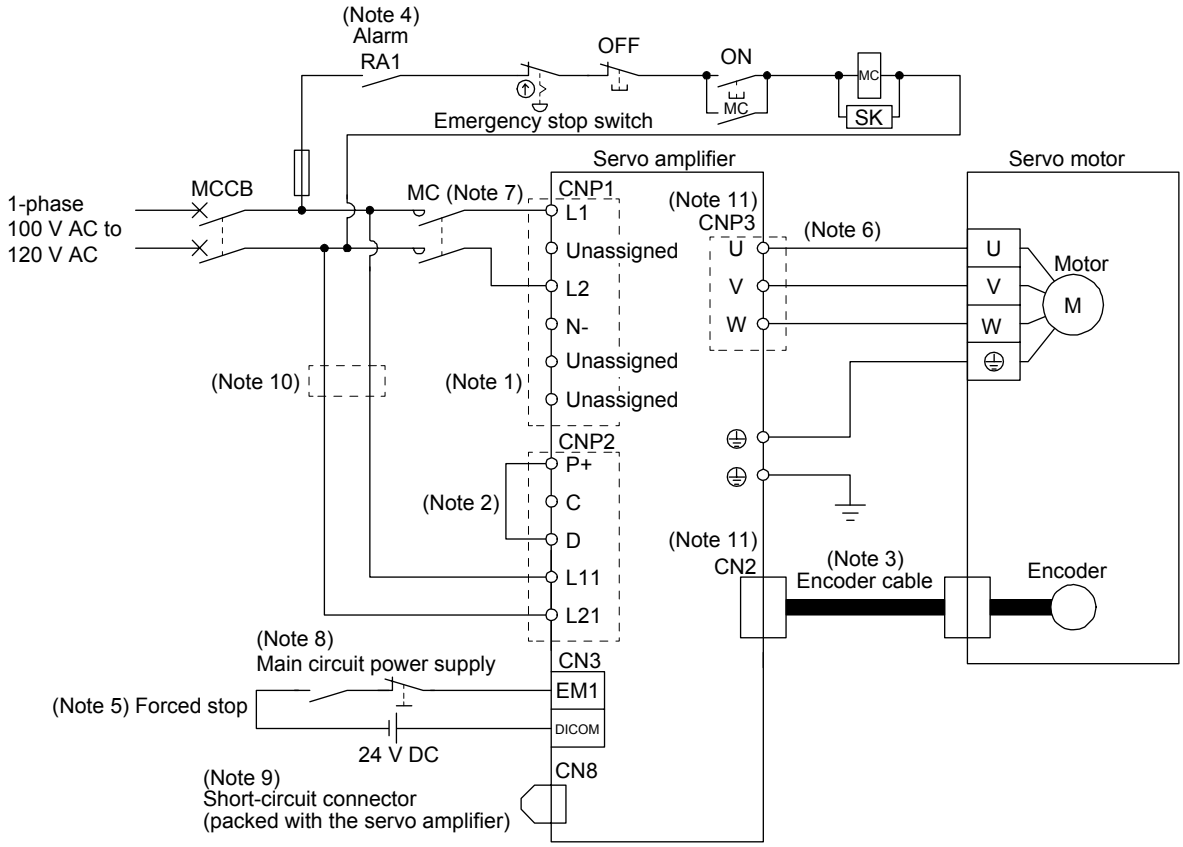
(8) MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020



Note 1. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

2. When using the regenerative resistor, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.
12. A step-down transformer is required when the coil voltage of the magnetic contactor is 200 V class.
13. Only HG-JR22K1M4 servo motor has a cooling fan.
14. For the cooling fan power supply, refer to "Servo Motor Instruction Manual (Vol. 3)".
15. Use an external dynamic brake for this servo amplifier. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at emergency stop. Ensure the safety in the entire equipment.

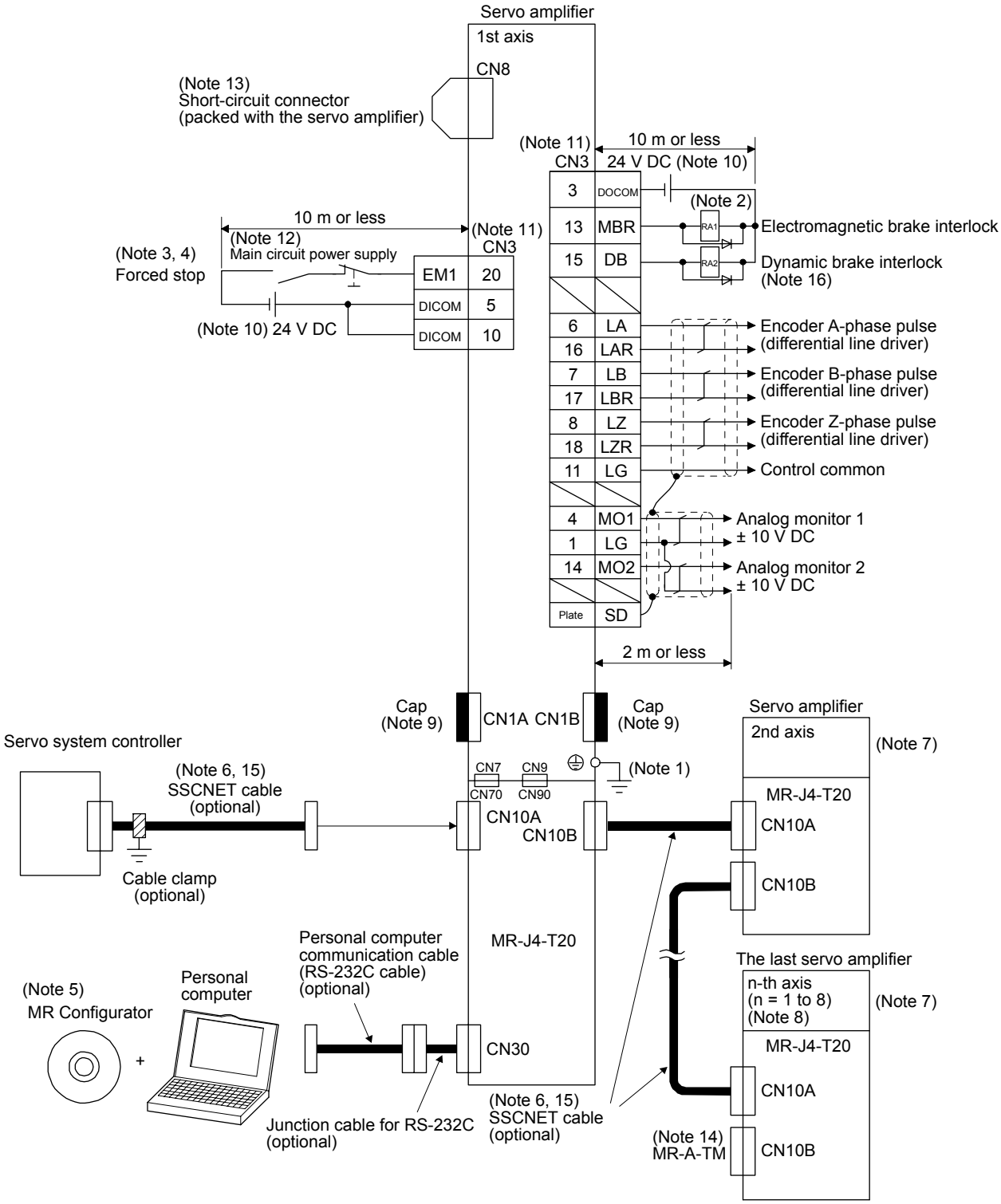
(9) MR-J4-10B1-RJ020/MR-J4-20B1-RJ020/MR-J4-40B1-RJ020



Note 1. The power factor improving DC reactor cannot be used.
2. Always connect between P+ and D terminals. (factory-wired) When using the regenerative option, refer to section 11.2.
3. For the encoder cable, use of the option cable is recommended. For selecting cables, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. This diagram shows sink input interface. For source input interface, refer to section 3.7.3.
6. For connecting servo motor power wires, refer to "Servo Motor Instruction Manual (Vol. 3)".
7. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of contacts) of 80 ms or less.
8. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
9. The STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1 and L2, use a molded-case circuit breaker. (Refer to section 11.10.)
11. Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

3.2 I/O signal connection example

3.2.1 For sink I/O interface



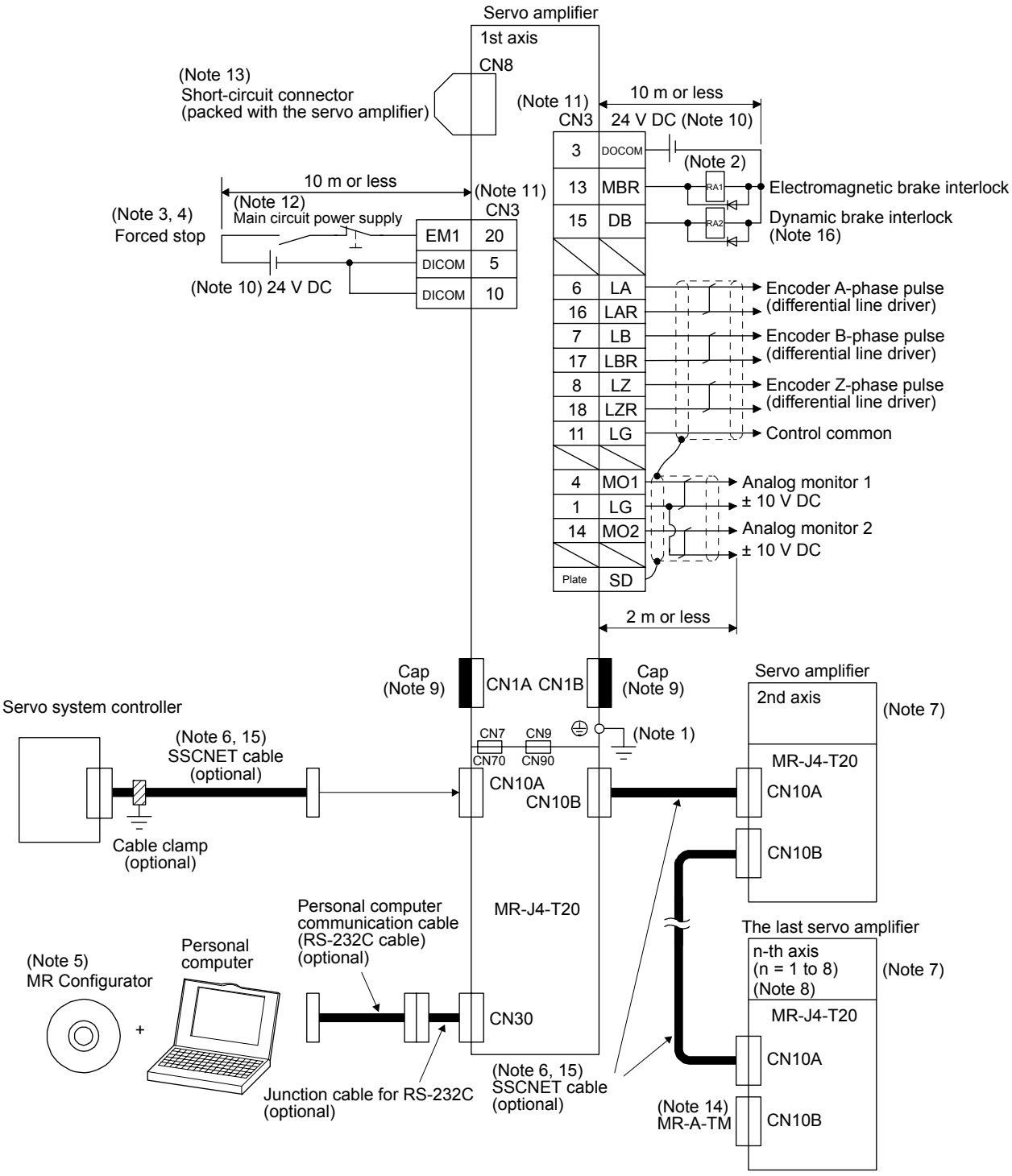
Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will malfunction and will not output signals, disabling EM1 (Forced stop) and other protective circuits.
3. If the controller does not have forced stop function, always install the forced stop switch (normally closed contact).
4. When starting operation, always turn on EM1 (Forced stop). (Normally closed contact)
5. Use MRZJW3-SETUP161E. (Refer to section 11.7.)
6. The SSCNET cables vary depending on servo system controllers connected. Refer to the following table for selecting SSCNET cables. Additionally, use MR-J2HBUS_M for the SSCNET cable to connect previous and next axis servo amplifiers.

Servo system controller		Servo amplifier
		MR-J4-_B_-RJ020 + MR-J4-T20 MR-J2S-_B_ MR-J2-03B5
Positioning module	QD75M	MR-J2HBUS_M
	A1SD75M	MR-J2HBUS_M-A
Motion controller	Q172CPU(N)	Q172J2BCBL_M(-B)
	Q173CPU(N)	Q173J2B_CBL_M
	A171SHCPU(N) A172SHCPU(N) A173UHCPU	MR-J2HBUS_M-A

7. The wiring after the second servo amplifier is omitted.
8. Up to 8 axes (n = 1 to 8) can be connected.
9. CN1A and CN1B cannot be used in J2S compatibility mode. Be sure to cap the CN1A and CN1B connectors.
10. Supply 24 V DC ± 10% to interfaces from outside. The total current capacity is up to 100 mA. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
11. The pins with the same signal name are connected in the servo amplifier.
12. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
13. STO function cannot be used in J2S compatibility mode. When using it, always attach the short-circuit connector came with a servo amplifier.
14. Always attach the terminal connector (MR-A-TM) to CN10B of the last servo amplifier.
15. Connect the SSCNET cable within the overall distance of 30 m. To enhance noise immunity, it is recommended that the cable clamp and data line filters (3 to 4pcs. connected in series) be attached near the servo system controller-side connector.
16. When using an external dynamic brake with 11 kw or more servo amplifier, set [Pr. 2] to "_ 1 _ _" to enable DB (Dynamic brake interlock).

3.2.2 For source I/O interface

POINT
●For notes, refer to section 3.2.1.



3.3 Explanation of power supply system

3.3.1 Signal explanations

POINT

●For the layout of connector and terminal block, refer to chapter 9 DIMENSIONS.

<table>
<tr><th>Symbol</th><th>Connection target (application)</th><th>Description</th></tr>
<tr><td>L1/L2/L3</td><td>Main circuit power supply</td><td>Supply the following power to L1, L2, and L3. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.
<table>
<tr><th>Servo amplifier / Power</th><th>MR-J4-10B-RJ020 to MR-J4-70B-RJ020</th><th>MR-J4-100B-RJ020 to MR-J4-22KB-RJ020</th></tr>
<tr><td>3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz</td><td colspan="2">L1/L2/L3</td></tr>
<tr><td>1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz</td><td>L1/L3</td><td></td></tr>
</table>
<table>
<tr><th>Servo amplifier / Power</th><th>MR-J4-60B4-RJ020 to MR-J4-22KB4-RJ020</th></tr>
<tr><td>3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz</td><td>L1/L2/L3</td></tr>
</table>
<table>
<tr><th>Servo amplifier / Power</th><th>MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020</th></tr>
<tr><td>1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz</td><td>L1/L2</td></tr>
</table></td></tr>
<tr><td>P3/P4</td><td>Power factor improving DC reactor</td><td>When not using the power factor improving DC reactor, connect P3 and P4. (factory-wired)
When using the power factor improving DC reactor, disconnect P3 and P4, and connect the power factor improving DC reactor to P3 and P4. Additionally, the power factor improving DC reactor cannot be used for the 100 V class servo amplifiers.
Refer to section 11.11 for details.</td></tr>
<tr><td>P+/C/D</td><td>Regenerative option</td><td>(1) 200 V/100 V class
1) MR-J4-500B-RJ020 or less/MR-J4-40B1-RJ020 or less
When using a servo amplifier built-in regenerative resistor, connect P+ and D. (factory-wired)
When using a regenerative option, disconnect P+ and D, and connect the regenerative option to P+ and C.
2) MR-J4-700B-RJ020 to MR-J4-22KB-RJ020
MR-J4-700B-RJ020 to MR-J4-22KB-RJ020 do not have D.
When using a servo amplifier built-in regenerative resistor, connect P+ and C. (factory-wired)
When using a regenerative option, disconnect wires of P+ and C for the built-in regenerative resistor. And then connect wires of the regenerative option to P+ and C.
(2) 400 V class
1) MR-J4-350B4-RJ020 or less
When using a servo amplifier built-in regenerative resistor, connect P+ and D. (factory-wired)
When using a regenerative option, disconnect P+ and D, and connect the regenerative option to P+ and C.
2) MR-J4-500B4-RJ020 to MR-J4-22KB4-RJ020
MR-J4-500B4-RJ020 to MR-J4-22KB4-RJ020 do not have D.
When using a servo amplifier built-in regenerative resistor, connect P+ and C. (factory-wired)
When using a regenerative option, disconnect wires of P+ and C for the built-in regenerative resistor. And then connect wires of the regenerative option to P+ and C.
Refer to section 11.2 for details.</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Connection target (application)</th><th>Description</th></tr>
<tr><td>L11/L21</td><td>Control circuit power supply</td><td>Supply the following power to L11 and L21.
<table>
<tr><td>Power \ Servo amplifier</td><td>MR-J4-10B-RJ020 to MR-J4-22KB-RJ020</td></tr>
<tr><td>1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz</td><td>L11/L21</td></tr>
</table>
<table>
<tr><td>Power \ Servo amplifier</td><td>MR-J4-60B4-RJ020 to MR-J4-22KB4-RJ020</td></tr>
<tr><td>1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz</td><td>L11/L21</td></tr>
</table>
<table>
<tr><td>Power \ Servo amplifier</td><td>MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020</td></tr>
<tr><td>1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz</td><td>L11/L21</td></tr>
</table></td></tr>
<tr><td>U/V/W</td><td>Servo motor power output</td><td>Connect the servo amplifier power output (U, V, and W) to the servo motor power input (U, V, and W) directly. Do not let a magnetic contactor, etc. intervene. Otherwise, it may cause a malfunction.</td></tr>
<tr><td>N-</td><td>Power regeneration converter
Power regeneration common converter
Brake unit</td><td>This terminal is used for a power regeneration converter, power regeneration common converter and brake unit.
Refer to section 11.3 to 11.5 for details.</td></tr>
<tr><td>⏚</td><td>Protective earth (PE)</td><td>Connect it to the grounding terminal of the servo motor and to the protective earth (PE) of the cabinet for grounding.</td></tr>
</table>

3.3.2 Power-on sequence

⚠CAUTION

●The following shows the initialization time (from turning on power until receiving servo-on command) of MR-J2S-_B_ servo amplifier and MR-J4-_B_-RJ020 servo amplifier.
- MR-J2S-_B_: maximum of 3 s
- MR-J4-_B_-RJ020: maximum of 4 s

Therefore, please note the following items when replacing MR-J2S-_B_ servo amplifier with MR-J4-_B_-RJ020 servo amplifier.
- When a release time of braking for preventing a drop of axis is adjusted with an external timer in a system which a moving part works vertically, the moving part can drop due to longer time until servo-lock. Please readjust the release time of braking or use MBR (Electromagnetic brake interlock).
- The time from power on until the servo motor begins to work can be longer.

POINT

●The voltage of analog monitor output, output signal, etc. may be unstable at power-on.

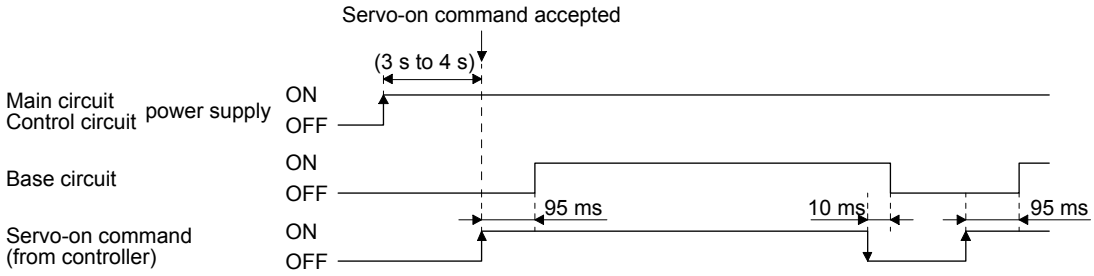
(1) Power-on procedure

1) Always wire the power supply as shown in section 3.1 using the magnetic contactor with the main circuit power supply (L1, L2, and L3). Configure an external sequence to switch off the magnetic contactor as soon as an alarm occurs.

2) Switch on the control circuit power supply (L11 and L21) simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the control circuit power supply is turned on with the main circuit power supply off, and then the servo-on command is transmitted, [AL. E9 Main circuit off warning] will occur. Turning on the main circuit power supply stops the warning and starts the normal operation.

3) The servo amplifier receives the servo-on command within 3 s to 4 s after the main circuit power supply is switched on.
(Refer to (2) of this section.)

(2) Timing chart



3.3.3 Wiring CNP1, CNP2, and CNP3

POINT
●For the wire sizes used for wiring, refer to section 11.9. ●MR-J4-500B-RJ020 or more/MR-J4-500B4-RJ020 or more do not have these connectors.

Use the servo amplifier power connector for wiring CNP1, CNP2, and CNP3.

(1) Connector

(a) MR-J4-10B-RJ020 to MR-J4-100B-RJ020

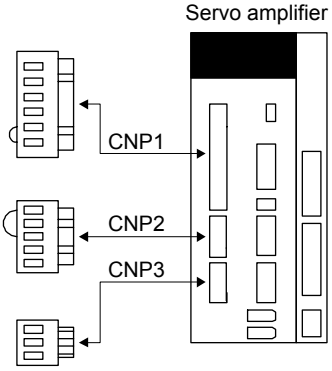


Table 3.1 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufacturer
		Size	Insulator OD			
CNP1	06JFAT-SAXGDK-H7.5	AWG 18 to 14	3.9 mm or less	9	J-FAT-OT	JST
CNP2	05JFAT-SAXGDK-H5.0					
CNP3	03JFAT-SAXGDK-H7.5					

(b) MR-J4-200B-RJ020/MR-J4-350B-RJ020

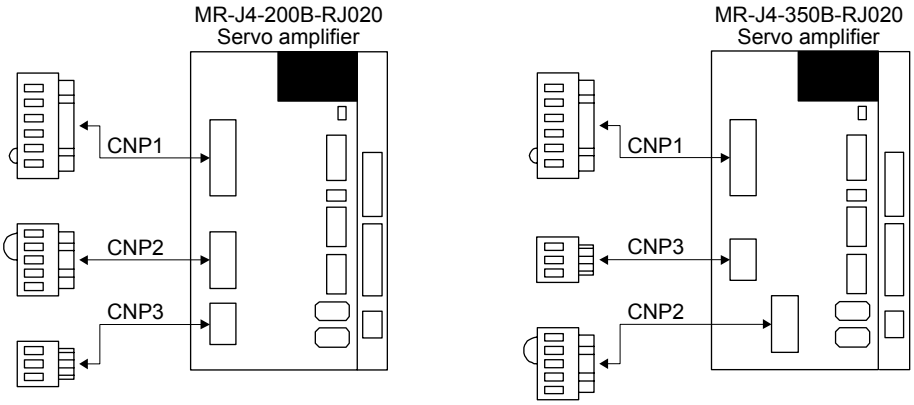


Table 3.2 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufacturer
		Size	Insulator OD			
CNP1	06JFAT-SAXGFK-XL	AWG 16 to 10	4.7 mm or less	11.5	J-FAT-OT-EXL	JST
CNP3	03JFAT-SAXGFK-XL					
CNP2	05JFAT-SAXGDK-H5.0	AWG 18 to 14	3.9 mm or less	9		

(c) MR-J4-60B4-RJ020 to MR-J4-350B4-RJ020

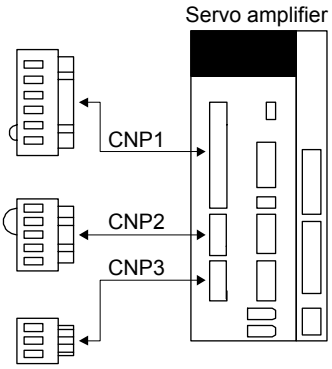


Table 3.3 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufac-turer
		Size	Insulator OD			
CNP1	06JFAT-SAXGDK-HT10.5	AWG 16 to 14	3.9 mm or less	10	J-FAT-OT-XL	JST
CNP2	05JFAT-SAXGDK-HT7.5					
CNP3	03JFAT-SAXGDK-HT10.5					

(d) MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020

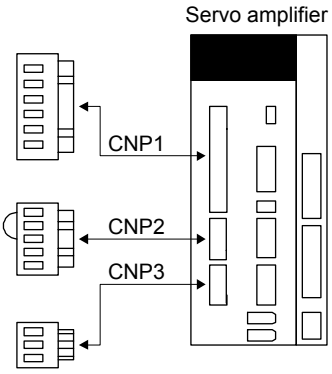


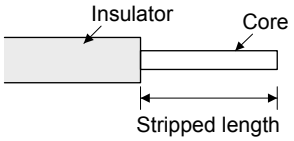
Table 3.4 Connector and applicable wire

Connector	Receptacle assembly	Applicable wire		Stripped length [mm]	Open tool	Manufac-turer
		Size	Insulator OD			
CNP1	06JFAT-SAXGDK-H7.5	AWG 18 to 14	3.9 mm or less	9	J-FAT-OT	JST
CNP2	05JFAT-SAXGDK-H5.0					
CNP3	03JFAT-SAXGDK-H7.5					

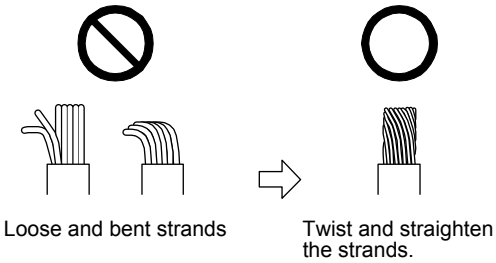
(2) Cable connection procedure

(a) Fabrication on cable insulator

Refer to table 3.1 to 3.4 for stripped length of cable insulator. The appropriate stripped length of cables depends on their type, etc. Set the length considering their status.



Twist strands lightly and straighten them as follows.



You can also use a ferrule to connect with the connectors. The following shows references to select ferrules according to wire sizes.

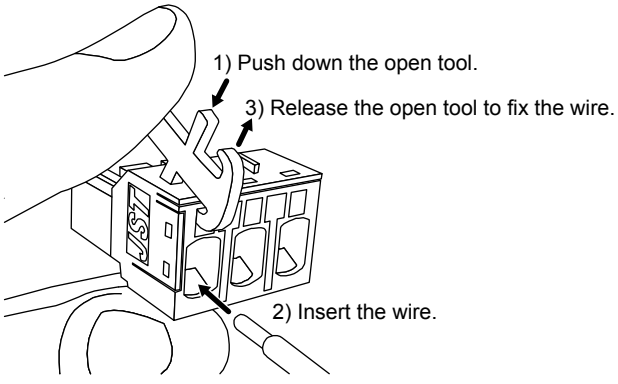
Servo amplifier	Wire size	Ferrule model (Phoenix Contact)		Crimping tool (Phoenix Contact)
		For one	For two	
MR-J4-10B-RJ020 to MR-J4-100B-RJ020	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	CRIMPFOX-ZA3
MR-J4-60B4-RJ020 to MR-J4-350B4-RJ020	AWG 14	AI2.5-10BU		
MR-J4-200B-RJ020 to MR-J4-350B-RJ020	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	
	AWG 14	AI2.5-10BU	AI-TWIN2×2.5-10BU	
	AWG 12	AI4-10GY		
MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020	AWG 16	AI1.5-10BK	AI-TWIN2×1.5-10BK	
	AWG 14	AI2.5-10BU		

(b) Inserting wire

Insert the open tool as follows and push down it to open the spring. While the open tool is pushed down, insert the stripped wire into the wire insertion hole. Check the insertion depth so that the wire insulator does not get caught by the spring.

Release the open tool to fix the wire. Pull the wire lightly to confirm that the wire is surely connected.

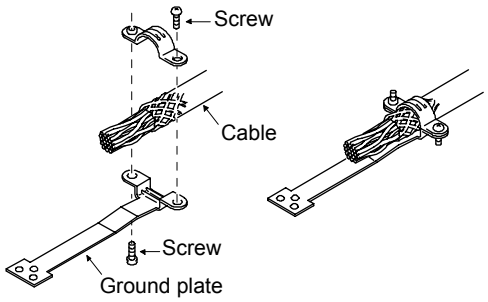
The following shows a connection example of the CNP3 connector for MR-J4-200B-RJ020/MR-J4-350B-RJ020.



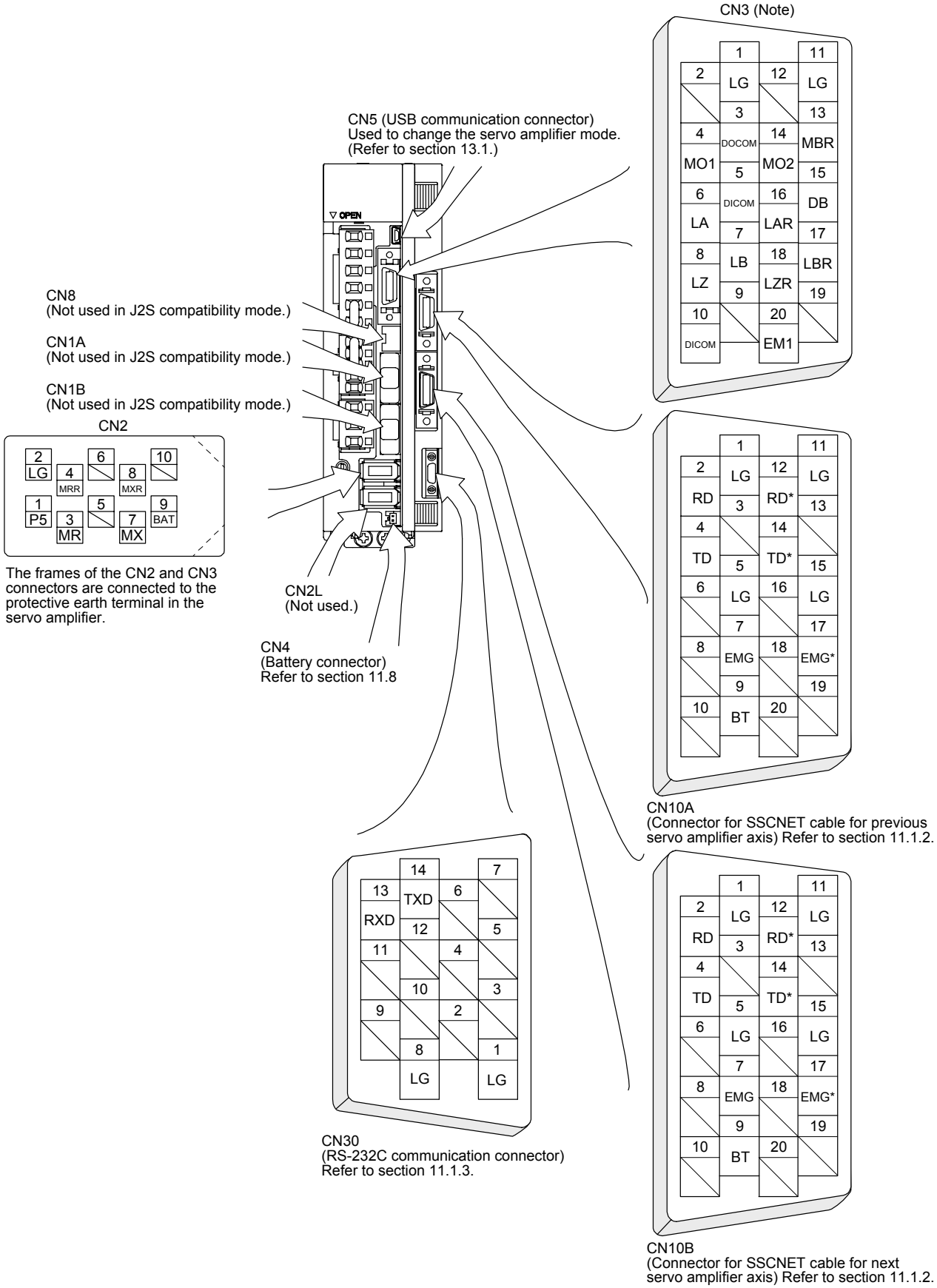
3.4 Connectors and pin assignment

POINT

- The pin assignment of the connectors are as viewed from the cable connector wiring section.
- The CN3 connector pin assignment is different between MR-J4-_B_-RJ020 and MR-J2S-_B_. Wire it correctly in accordance with this section.
- For the CN3 connector, securely connect the external conductor of the shielded cable to the ground plate and fix it to the connector shell.



The servo amplifier front view shown is that of the MR-J4-20B-RJ020 and MR-J4-T20. Refer to chapter 9 DIMENSIONS for the appearances and connector layouts of the other servo amplifiers.


CN3 (Note)
CN5 (USB communication connector)
Used to change the servo amplifier mode.
(Refer to section 13.1.)
CN8
(Not used in J2S compatibility mode.)
CN1A
(Not used in J2S compatibility mode.)
CN1B
(Not used in J2S compatibility mode.)
CN2
The frames of the CN2 and CN3 connectors are connected to the protective earth terminal in the servo amplifier.
CN2L
(Not used.)
CN4
(Battery connector)
Refer to section 11.8
CN10A
(Connector for SSCNET cable for previous servo amplifier axis) Refer to section 11.1.2.
CN30
(RS-232C communication connector)
Refer to section 11.1.3.
CN10B
(Connector for SSCNET cable for next servo amplifier axis) Refer to section 11.1.2.

Note. The CN3 connector pin assignment is different between MR-J4-_B_-RJ020 and MR-J2S-_B_. Refer to the following table.

CN3 connector Pin No.	Symbol		Precautions when replacing MR-J2S-_B_
	MR-J2S-_B_	MR-J4-_B_-RJ020	
2	RXD		This is for manufacturer setting. Leave this open. Connect RXD to the CN30 connector of MR-J4-T20 (13 pins).
3	SG	DOCOM	A 24 V DC external power supply for interface is necessary. Review the wiring.
5	COM	DICOM	
10	VDD	DICOM	
12	TXD		This is for manufacturer setting. Leave this open. Connect TXD to the CN30 connector of MR-J4-T20 (14 pins).

3.5 Signal (device) explanations

For the I/O interfaces (symbols in I/O division column in the table), refer to section 3.7.2.

3.5.1 Input device

Device	Symbol	Connector Pin No.	Function and application	I/O division
Forced stop	EM1	CN3-20	Turn EM1 off (open between commons) to bring the motor to a forced stop state. The base circuit is shut off, the dynamic brake is operated and decelerate the servo motor to a stop. Turn EM1 on (short between commons) in the forced stop state to reset that state.	DI-1

3.5.2 Output device

Device	Symbol	Connector Pin No.	Function and application	I/O division
Electromagnetic brake interlock	MBR	CN3-13	When using the device, set operation delay time of the electromagnetic brake in [Pr. 21]. When a servo-off status or alarm occurs, MBR will turn off.	DO-1
Dynamic brake interlock	DB	CN3-15	To use the device, set [Pr. 2] to "_ 1 _ _". DB turns off when the dynamic brake needs to operate. When using the external dynamic brake on the servo amplifier of 11 kW or more, this device is required. (Refer to section 11.17.) For the servo amplifier of 7 kW or less, it is not necessary to use this device.	DO-1

3.5.3 Output signal

Signal name	Symbol	Connector pin No.	Function and application
Encoder A-phase pulse (differential line driver)	LA LAR	CN3-6 CN3-16	These signals output pulses per servo motor revolution set in [Pr. 38] in the differential line driver type. In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-phase pulse by a phase angle of π/2. Output pulse specification and dividing ratio setting can be selected with [Pr. 33].
Encoder B-phase pulse (differential line driver)	LB LBR	CN3-7 CN3-17	
Encoder Z-phase pulse (differential line driver)	LZ LZR	CN3-8 CN3-18	The encoder zero-point signal is outputted in the differential line driver type. One pulse is outputted per servo motor revolution. This turns on when the zero-point position is reached. (negative logic) The minimum pulse width is about 400 μs. For home position return using this pulse, set the creep speed to 100 r/min. or less.
Analog monitor 1	MO1	CN3-4	This is used to output the data set in [Pr. 22] between MO1 and LG in voltage. Resolution: 10 bits or equivalent
Analog monitor 2	MO2	CN3-14	This signal outputs the data set in [Pr. 22] between MO2 and LG in voltage. Resolution: 10 bits or equivalent

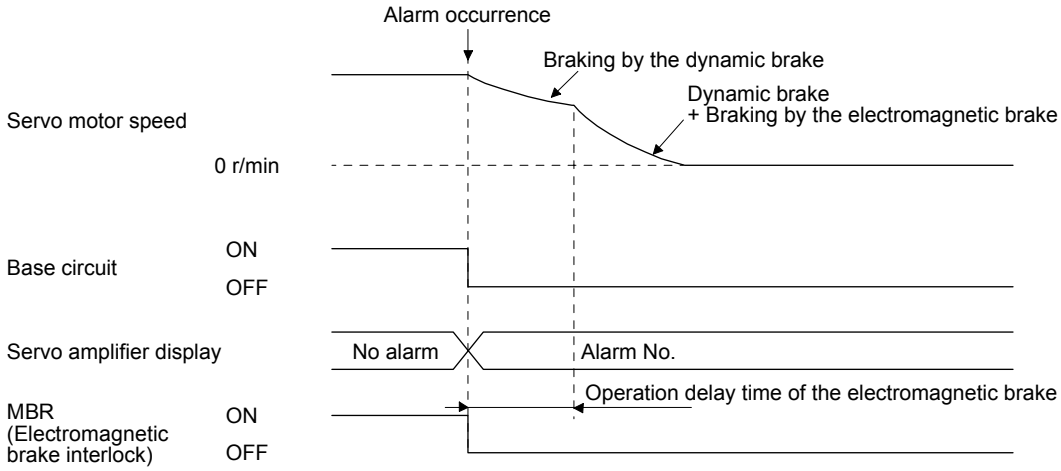
3.5.4 Power supply

Signal name	Symbol	Connector Pin No.	Function and application
Digital I/F power supply input	DICOM	CN3-5 CN3-10	Input 24 V DC (24 V DC ± 10% 100 mA) for I/O interface. The power supply capacity changes depending on the number of I/O interface points to be used. For sink interface, connect + of 24 V DC external power supply. For source interface, connect - of 24 V DC external power supply.
Digital I/F common	DOCOM	CN3-3	Common terminal of input signal such as EM1 of the servo amplifier. This is separated from LG. For sink interface, connect - of 24 V DC external power supply. For source interface, connect + of 24 V DC external power supply.
Monitor common	LG	CN3-1 CN3-11	Common terminal of MO1 and MO2. Pins are connected internally.
Shield	SD	Plate	Connect the external conductor of the shielded wire.

3.6 Alarm occurrence timing chart

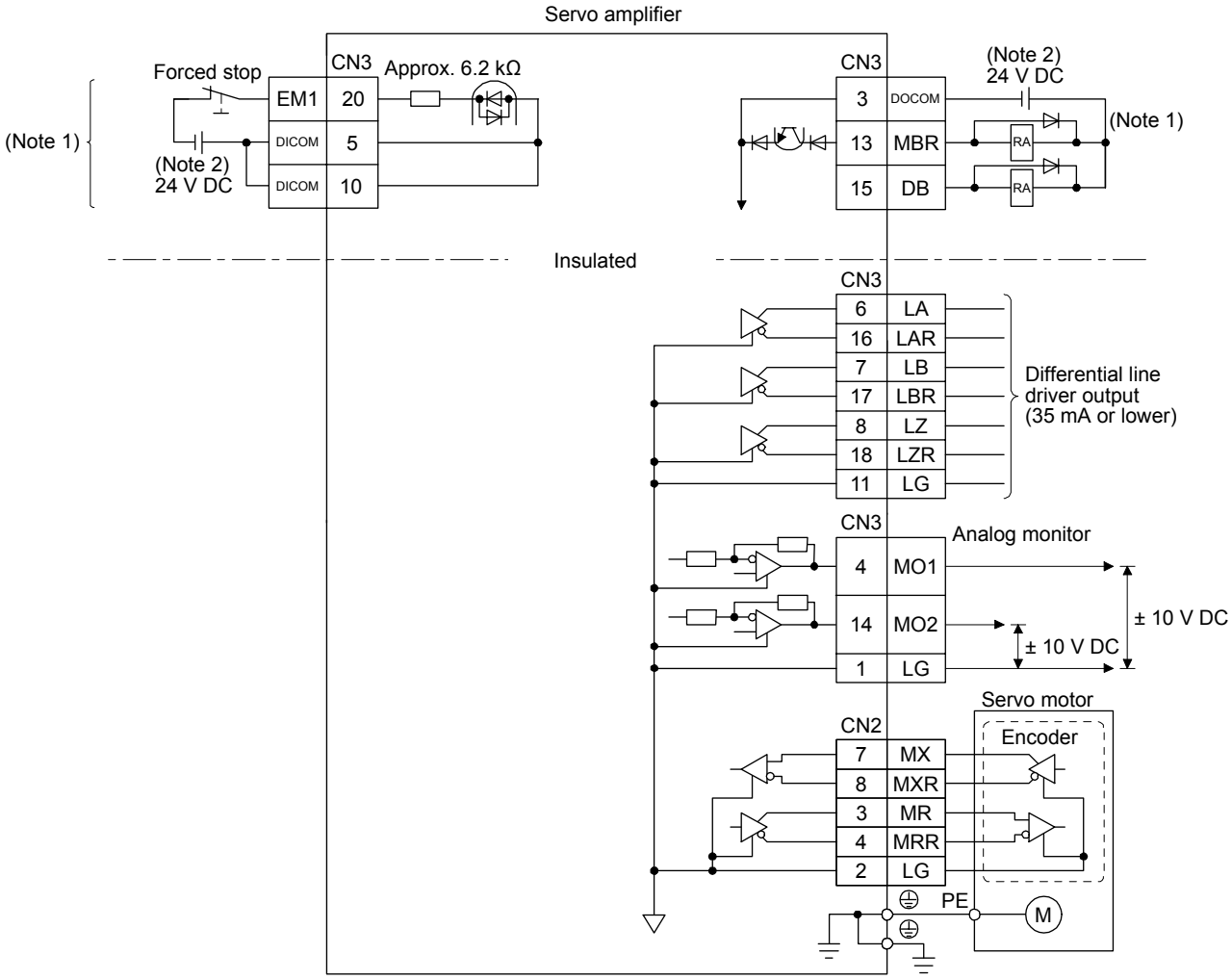
⚠CAUTION	●When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation.

To deactivate the alarm, cycle the control circuit power or give the error reset or CPU reset command from the servo system controller. However, the alarm cannot be deactivated unless its cause is removed.



3.7 Interfaces

3.7.1 Internal connection diagram



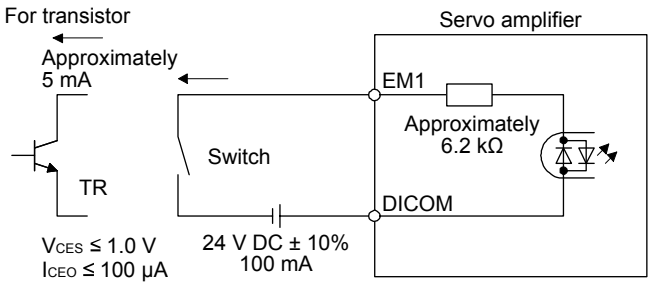
Note 1. This diagram shows sink I/O interface. For source I/O interface, refer to section 3.7.3.
2. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

3.7.2 Detailed explanation of interfaces

This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 3.5. Refer to this section and make connection with the external device.

(1) Digital input interface DI-1

This is an input circuit whose photocoupler cathode side is input terminal. Transmit signals from sink (open-collector) type transistor output, relay switch, etc. The following is a connection diagram for sink input. Refer to section 3.7.3 for source input.



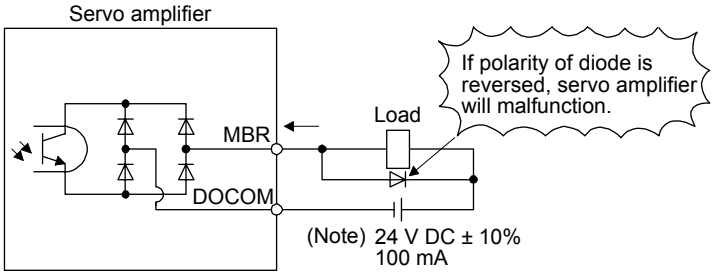
(2) Digital output interface DO-1

This is a circuit in which the collector side of the output transistor is the output terminal. When the output transistor is turned on, the current flows from the collector terminal.

A lamp, relay or photocoupler can be driven. Install a diode (D) for an inductive load, or install an inrush current suppressing resistor (R) for a lamp load.

(Rated current: 40 mA or less, maximum current: 50 mA or less, inrush current: 100 mA or less) A maximum of 2.6 V voltage drop occurs in the servo amplifier.

The following shows a connection diagram for sink output. Refer to section 3.7.3 for source output.

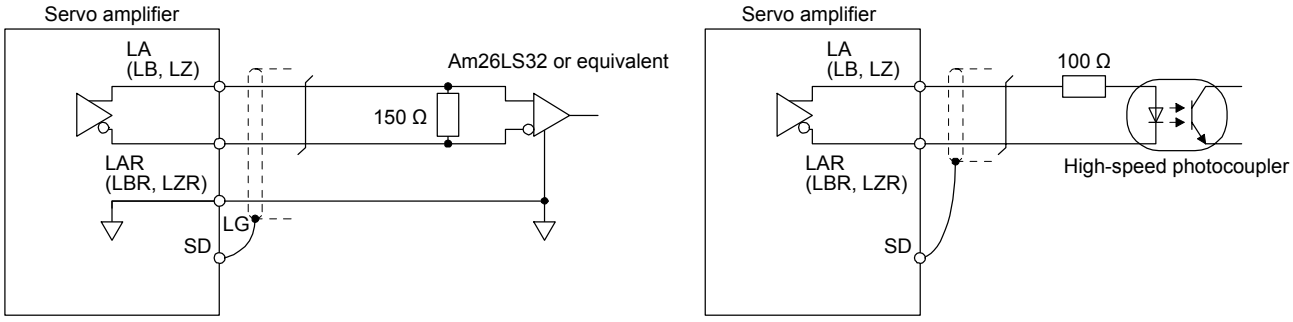


Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

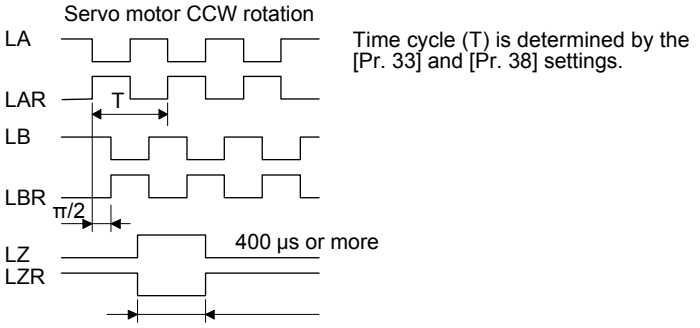
(3) Encoder output pulses DO-2 (differential line driver type)

(a) Interface

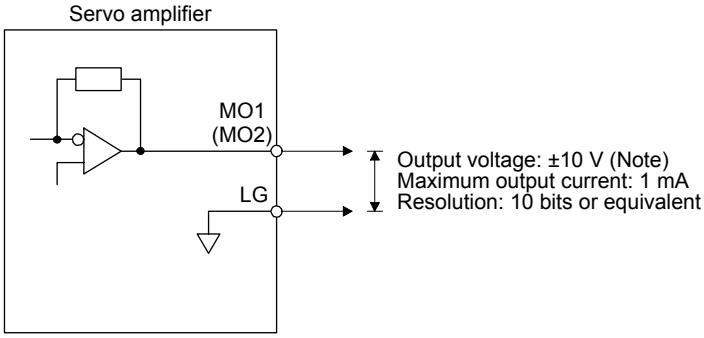
Maximum output current: 35 mA



(b) Output pulse



(4) Analog output



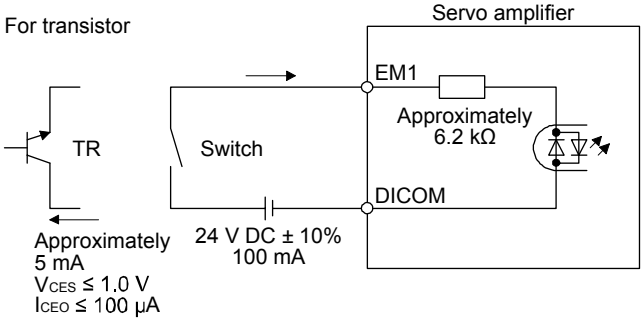
Note. Output voltage range varies depending on the output contents.

3.7.3 Source I/O interfaces

In this servo amplifier, source type I/O interfaces can be used.

(1) Digital input interface DI-1

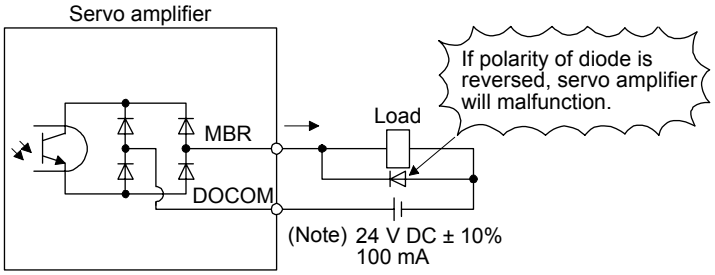
This is an input circuit whose photocoupler anode side is the input terminal. Transmit signals from source (open-collector) type transistor output, relay switch, etc.



(2) Digital output interface DO-1

This is a circuit in which the emitter side of the output transistor is the output terminal. When the output transistor is turned on, the current flows from the output terminal to a load.

A maximum of 2.6 V voltage drop occurs in the servo amplifier.



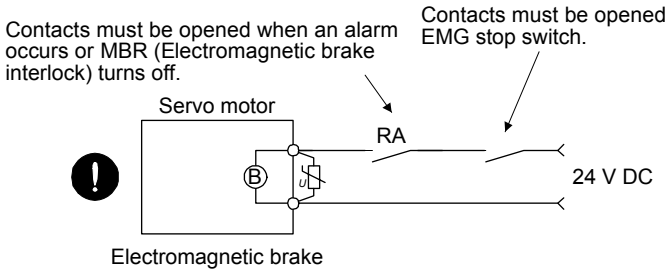
Note. If the voltage drop (maximum of 2.6 V) interferes with the relay operation, apply high voltage (maximum of 26.4 V) from external source.

3.8 Servo motor with an electromagnetic brake

3.8.1 Safety precautions

⚠CAUTION

●Configure an electromagnetic brake circuit so that it is activated also by an external EMG stop switch.


Contacts must be opened when an alarm occurs or MBR (Electromagnetic brake interlock) turns off.
Contacts must be opened with the EMG stop switch.
Servo motor
RA
24 V DC
Electromagnetic brake

●The electromagnetic brake is provided for holding purpose and must not be used for ordinary braking.

●Before operating the servo motor, be sure to confirm that the electromagnetic brake operates properly.

●Do not use the 24 V DC interface power supply for the electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake. Otherwise, it may cause a malfunction.

POINT

●Refer to "Servo Motor Instruction Manual (Vol. 3)" for specifications such as the power supply capacity and operation delay time of the electromagnetic brake.

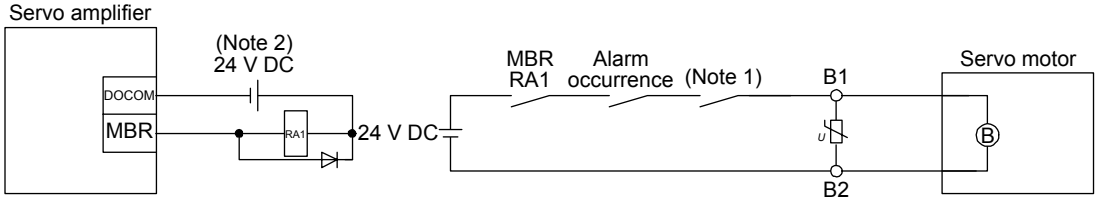
●Refer to "Servo Motor Instruction Manual (Vol. 3)" for the selection of a surge absorber for the electromagnetic brake.

Note the following when the servo motor with an electromagnetic brake is used.

1) The brake will operate when the power (24 V DC) turns off.

2) Turn off the servo-on command after the servo motor stopped.

(1) Connection diagram



Note 1. Create the circuit in order to shut off by interlocking with the EMG stop switch.
2. Do not use the 24 V DC interface power supply for the electromagnetic brake.

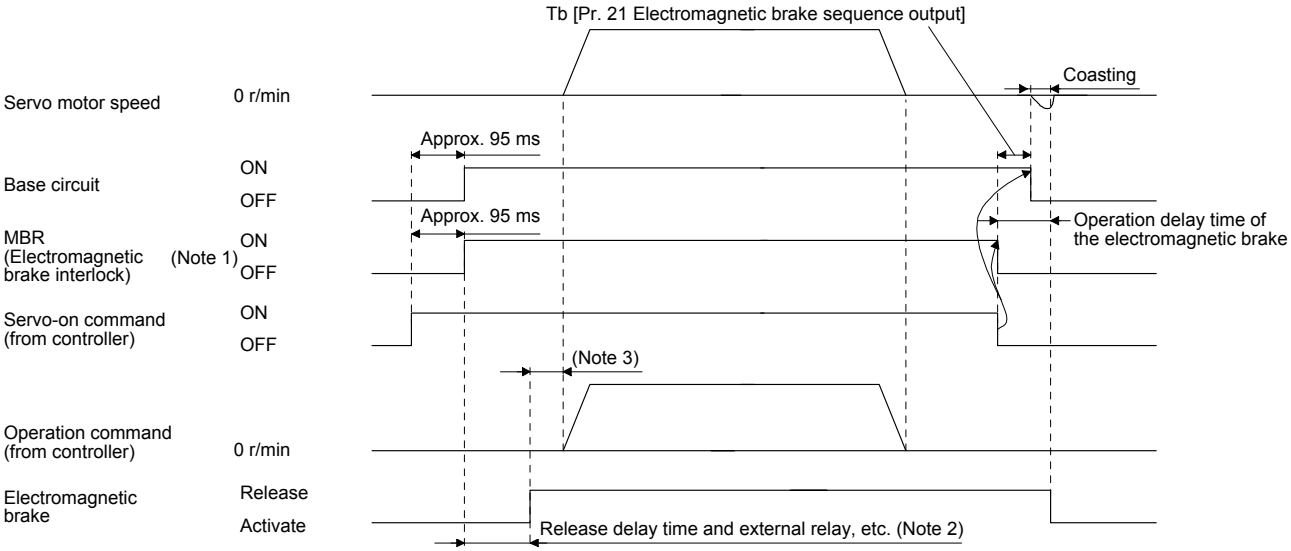
(2) Setting

In [Pr. 21 Electromagnetic brake sequence output], set a delay time (Tb) from MBR (Electromagnetic brake interlock) off to base circuit shut-off at a servo-off as in the timing chart in section 3.8.2.

3.8.2 Timing chart

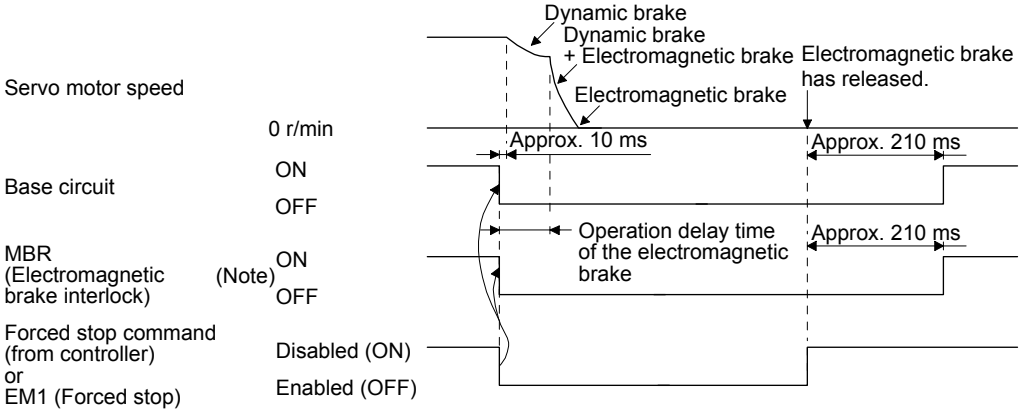
(1) Servo-on command (from controller) on/off

When servo-on command is turned off, the servo lock will be released after Tb [ms], and the servo motor will coast. If the electromagnetic brake is enabled during servo-lock, the brake life may be shorter. Therefore, set Tb about 1.5 times of the minimum delay time where the moving part will not drop down for a vertical axis system, etc.



Note 1. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.
2. Electromagnetic brake is released after the release delay time of electromagnetic brake and operation time of external circuit relay, etc. For the release delay time of electromagnetic brake, refer to "Servo Motor Instruction Manual (Vol. 3)".
3. Give the operation command from the controller after the electromagnetic brake is released.

(2) Off/on of the forced stop command (from controller) or EM1 (Forced stop)

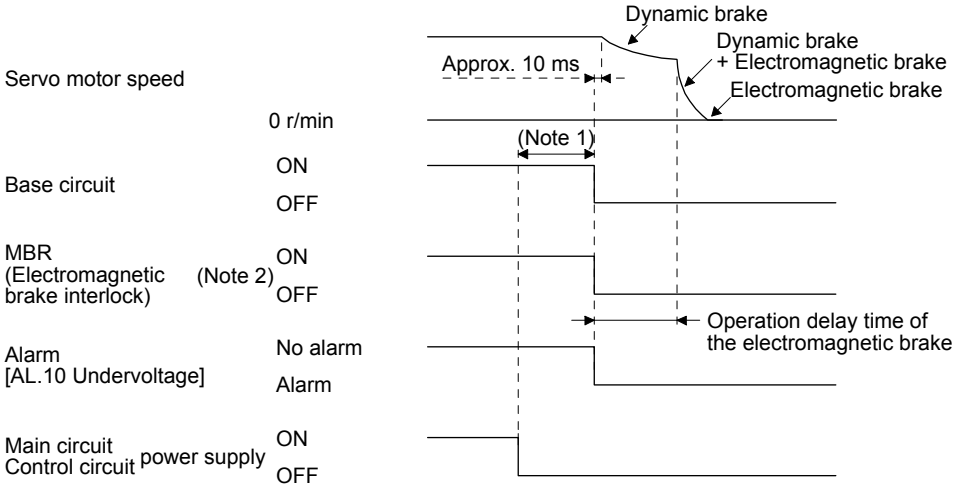


Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

(3) Alarm occurrence

The operation status during an alarm is the same as section 3.6.

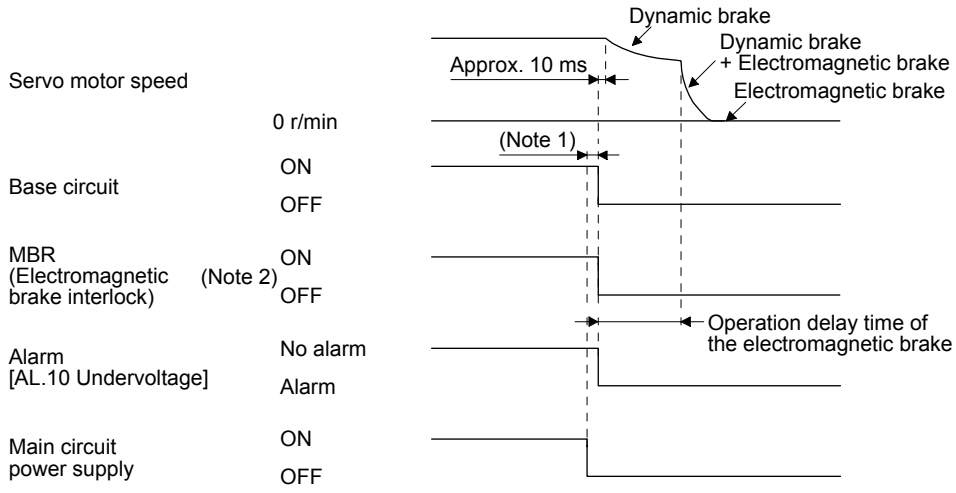
(4) Both main and control circuit power supplies off



Note 1. Variable according to the operation status.

2. ON: Electromagnetic brake is not activated.
   OFF: Electromagnetic brake has been activated.

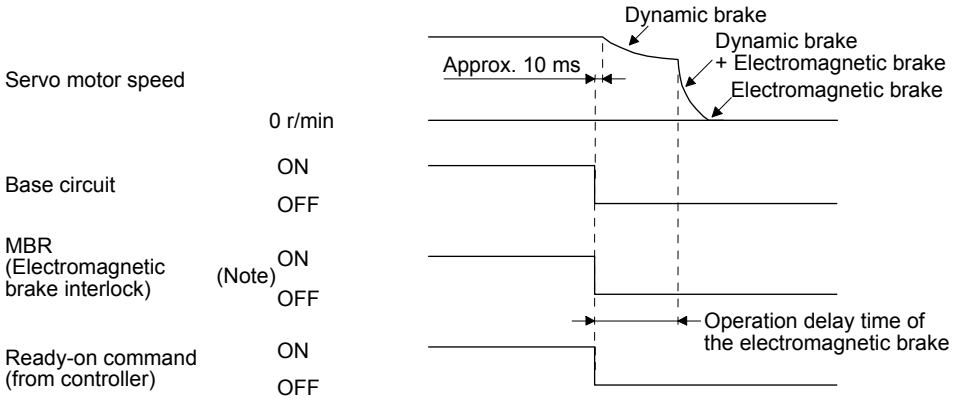
(5) Main circuit power supply off during control circuit power supply on



Note 1. Variable according to the operation status.

2. ON: Electromagnetic brake is not activated.
   OFF: Electromagnetic brake has been activated.

(6) Ready-off command from controller

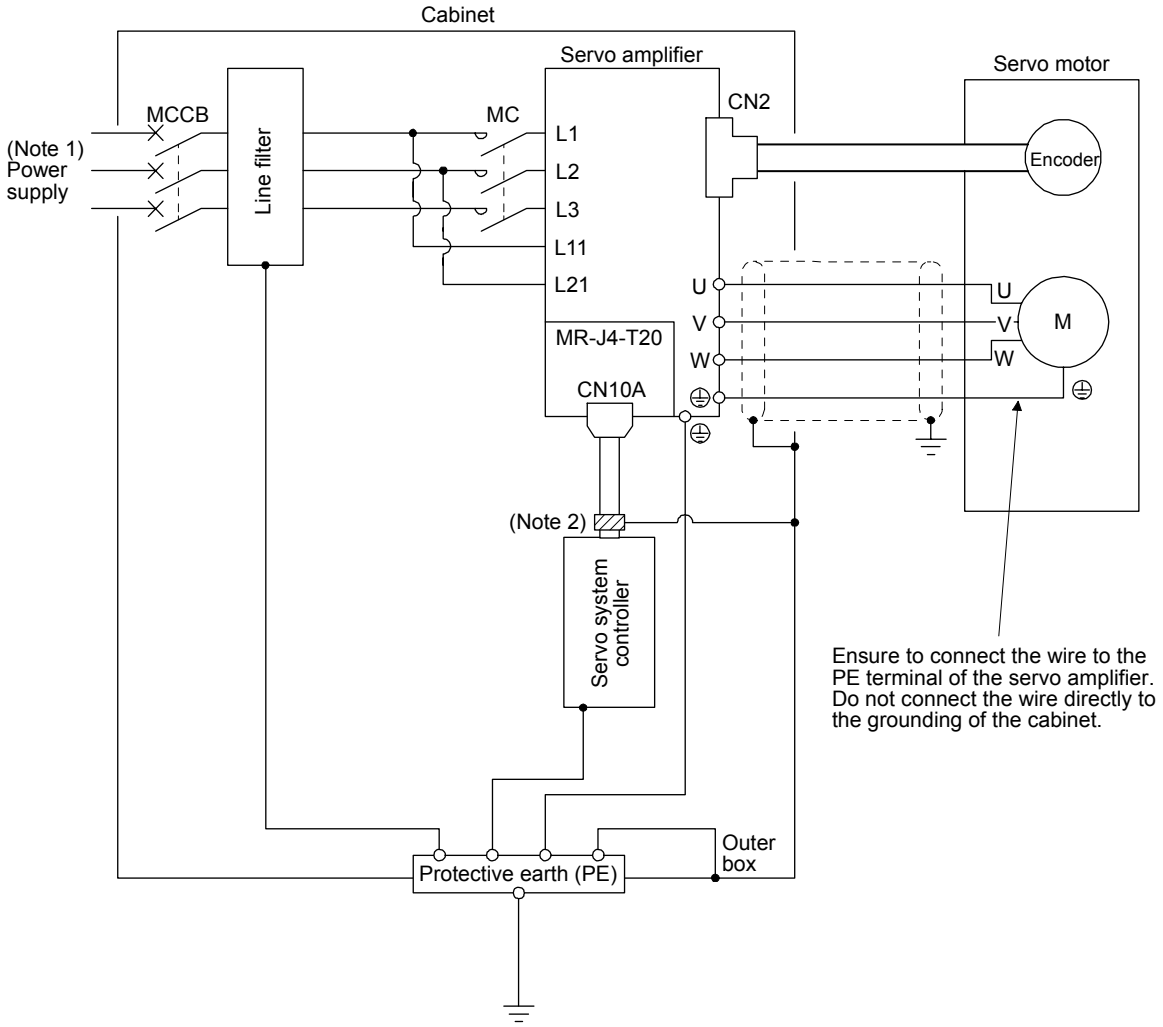


Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake has been activated.

3.9 Grounding

⚠WARNING
- Ground the servo amplifier and servo motor securely.
- To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet.

The servo amplifier switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cable routing, the servo amplifier may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.
To conform to the EMC Directive, refer to the EMC Installation Guidelines (IB(NA)67310).



Note 1. For the power supply specifications, refer to section 1.3.
2. To reduce the influence of the external noise, it is recommended to attach a cable clamp fitting to ground the SSCNET cable or connect 3 to 4 data line filters in series near the servo system controller.

4. STARTUP

⚠WARNING	●Do not operate the switches with wet hands. Otherwise, it may cause an electric shock.

⚠CAUTION	●Before starting operation, check the parameters. Improper settings may cause some machines to operate unexpectedly. ●The servo amplifier heat sink, regenerative resistor, servo motor, etc. may be hot while power is on or for some time after power-off. Take safety measures, e.g. provide covers, to avoid accidentally touching the parts (cables, etc.) by hand. ●During operation, never touch the rotor of the servo motor. Otherwise, it may cause injury.

POINT

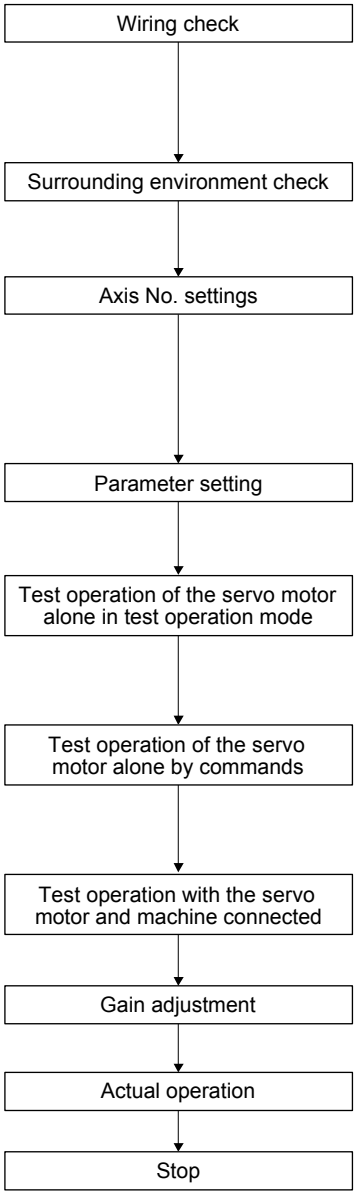
●Before switching power on, install MR-J4-T20 to the MR-J4-_B_-RJ020 servo amplifier. For the MR-J4-T20 installation procedure, refer to section 1.8.

4. STARTUP

4.1 Switching power on for the first time

When switching power on for the first time, follow this section to make a startup.

4.1.1 Startup procedure


Wiring check
Surrounding environment check
Axis No. settings
Parameter setting
Test operation of the servo motor alone in test operation mode
Test operation of the servo motor alone by commands
Test operation with the servo motor and machine connected
Gain adjustment
Actual operation
Stop

Check whether the servo amplifier and servo motor are wired correctly using visual inspection, DO forced output function (section 4.5.1), etc. (Refer to section 4.1.2.)

Check the surrounding environment of the servo amplifier and servo motor. (Refer to section 4.1.3.)

Confirm that the control axis No. set with the axis selection rotary switch (SW1) matches the control axis No. set with the servo system controller. (Refer to section 4.3.1.)

Set the parameters as necessary, such as the used operation mode and regenerative option selection. (Refer to chapter 5.)

For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, check whether the servo motor rotates correctly. (Refer to section 4.5.)

For the test operation with the servo motor disconnected from the machine and operated at the speed as low as possible, give commands to the servo amplifier and check whether the servo motor rotates correctly.

After connecting the servo motor with the machine, check machine motions with sending operation commands from the servo system controller.

Make gain adjustment to optimize the machine motions. (Refer to chapter 6.)

Stop giving commands and stop operation.

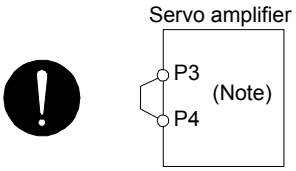
4.1.2 Wiring check

(1) Power supply system wiring
Before switching on the main circuit and control circuit power supplies, check the following items.

(a) Power supply system wiring

1) The power supplied to the power input terminals (L1, L2, L3, L11, and L21) of the servo amplifier should satisfy the defined specifications. (Refer to section 1.3.)

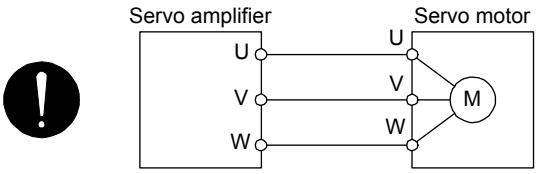
2) When the power factor improving DC reactor is not used, between P3 and P4 should be connected.



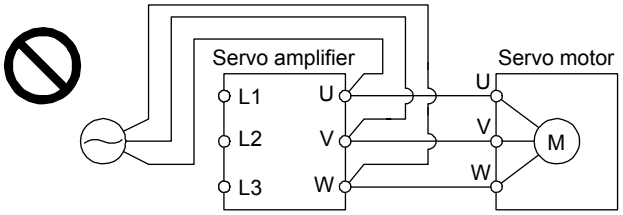
Note. The 100 V class servo amplifiers do not have P3 and P4.

(b) Connection of servo amplifier and servo motor

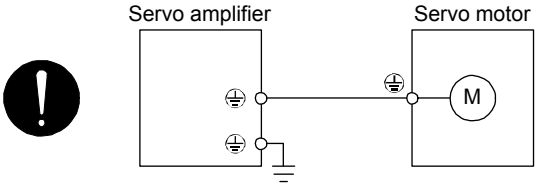
1) The servo amplifier power output (U, V, and W) should match in phase with the servo motor power input terminals (U, V, and W).



2) The power supplied to the servo amplifier should not be connected to the power outputs (U, V, and W). Doing so will fail the connected servo amplifier and servo motor.



3) The grounding terminal of the servo motor is connected to the PE terminal of the servo amplifier.



4) The CN2 connector of the servo amplifier should be connected to the encoder of the servo motor securely using the encoder cable.

(c) When you use an option and peripheral equipment

1) 200 V class

a) When you use a regenerative option for 5 kW or less servo amplifiers

- The lead wire between P+ terminal and D terminal should not be connected.
- The regenerative option should be connected to P+ terminal and C terminal.
- A twisted cable should be used. (Refer to section 11.2.4.)

b) When you use a regenerative option for 7 kW or more servo amplifiers

- For 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
- The regenerative option should be connected to P+ terminal and C terminal.
- A twisted cable should be used. (Refer to section 11.2.4.)

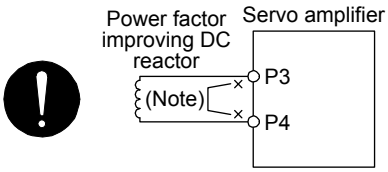
c) When you use a brake unit and power regeneration converter for 5 kW or more servo amplifiers

- For 5 kW, the lead wire between P+ terminal and D terminal should not be connected.
- For 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
- Wires of a brake unit or power regeneration converter should be connected to P+ terminal and N- terminal. (Refer to section 11.3 to 11.4.)
- A twisted cable should be used when wiring is over 5 m and under 10 m using a brake unit. (Refer to section 11.3.)

d) When you use a power regeneration common converter

- For 5 kW or less, the lead wire between P+ terminal and D terminal should not be connected.
- For 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should not be connected.
- The wire of power regeneration common converter should be connected to P4 terminal and N- terminal. (Refer to section 11.5.)

e) The power factor improving DC reactor should be connected between P3 and P4. (Refer to section 11.11.)



Note. Always disconnect between P3 and P4.

2) 400 V class

a) When you use a regenerative option for 3.5 kW or less servo amplifiers

- The lead wire between P+ terminal and D terminal should not be connected.
- The regenerative option should be connected to P+ terminal and C terminal.
- A twisted cable should be used. (Refer to section 11.2.4.)

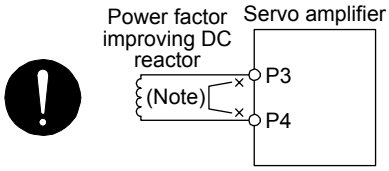
b) When you use a regenerative option for 5 kW or more servo amplifiers

- For 5 kW and 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should be removed.
- The regenerative option should be connected to P+ terminal and C terminal.
- A twisted cable should be used. (Refer to section 11.2.4.)

c) When you use a brake unit and power regeneration converter for 5 kW or more servo amplifiers
- For 5 kW and 7 kW, the lead wire of built-in regenerative resistor connected to P+ terminal and C terminal should be removed.
- Wires of a brake unit or power regeneration converter should be connected to P+ terminal and N- terminal. (Refer to section 11.3 to 11.4.)
- A twisted cable should be used when wiring is over 5 m and under 10 m using a brake unit. (Refer to section 11.3.)

d) When you use a power regeneration common converter for 11 kW or more servo amplifiers
- The wire of power regeneration common converter should be connected to P4 terminal and N- terminal. (Refer to section 11.5.)

e) The power factor improving DC reactor should be connected between P3 and P4. (Refer to section 11.11.)



Note. Always disconnect between P3 and P4.

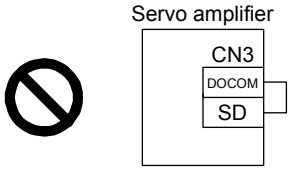
3) 100 V class
- The lead wire between P+ terminal and D terminal should not be connected.
- The regenerative option should be connected to P+ terminal and C terminal.
- A twisted cable should be used. (Refer to section 11.2.4.)

(2) I/O signal wiring

(a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN3 connector. This function can be used to perform a wiring check. In this case, switch on the control circuit power supply only.
Refer to section 3.2 for details of I/O signal connection.

(b) A voltage exceeding 24 V DC is not applied to the pins of the CN3 connector.

(c) Between SD and DOCOM of the CN3 connector should not be shorted.



4.1.3 Surrounding environment

(1) Cable routing

(a) The wiring cables should not be stressed.

(b) The encoder cable should not be used in excess of its bending life. (Refer to section 10.4.)

(c) The connector of the servo motor should not be stressed.

(2) Environment

Signal cables and power cables are not shorted by wire offcuts, metallic dust or the like.

4.2 Startup

Connect the servo motor with a machine after confirming that the servo motor operates properly alone.

(1) Power on

When the main and control circuit power supplies are turned on, "b1" (for the first axis) appears on the servo amplifier display.

When you use the absolute position detection system, first power-on results in [AL. 25 Absolute position erased] and the servo system cannot be switched on. The alarm can be deactivated by then switching power off once and on again.

Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

(2) Parameter setting

POINT

●The following encoder cables are of four-wire type. When using any of these encoder cables, set [Pr. 23] to "_ 1 _ _" to select the four-wire type. Incorrect setting will result in [AL. 16 Encoder error 1].

MR-EKCBL30M-L
MR-EKCBL30M-H
MR-EKCBL40M-H
MR-EKCBL50M-H
MR-ESCBL30M-L
MR-ESCBL30M-H
MR-ESCBL40M-H
MR-ESCBL50M-H

Set the parameters according to the structure and specifications of the machine. Refer to chapter 5 for details.

After setting the above parameters, turn off the power as necessary. Then switch power on again to enable the parameter values.

(3) Servo-on

Enable the servo-on with the following procedure.

(a) Switch on main circuit power supply and control circuit power supply.

(b) Transmit the servo-on command with the servo system controller.

When the servo-on status is enabled, the servo amplifier is ready to operate and the servo motor is locked.

(4) Home position return

Always perform home position return before starting positioning operation.

(5) Stop

If any of the following situations occurs, the servo amplifier suspends the running of the servo motor and brings it to a stop.

Refer to section 3.8 for the servo motor with an electromagnetic brake.

	Operation/command	Stopping condition
Servo system controller	Servo-off command	The base circuit is shut off and the servo motor coasts.
	Ready-off command	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.
	Forced stop command	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop. [AL. E7 Controller forced stop warning] occurs.
Servo amplifier	Alarm occurrence	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop.
	EM1 (Forced stop) off	The base circuit is shut off and the dynamic brake operates to bring the servo motor to a stop. [AL. E6 Servo forced stop warning] occurs.

4.3 Switch setting and display of the servo amplifier

Switching to the test operation mode and setting control axis No. are enabled with switches on the servo amplifier.

On the servo amplifier display (three-digit, seven-segment LED), check the status of communication with the servo system controller at power-on, and the axis number, and diagnose a malfunction at occurrence of an alarm.

4.3.1 Switches

⚠WARNING

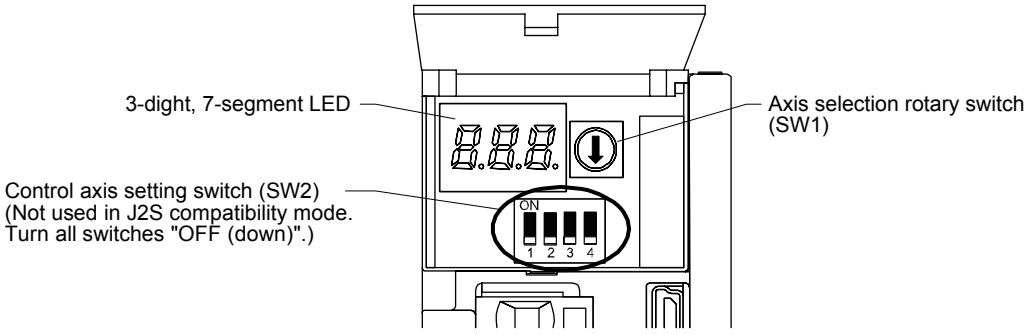
●When switching the axis selection rotary switch (SW1) and auxiliary axis number setting switch (SW2), use an insulated screw driver. Do not use a metal screw driver. Touching patterns on electronic boards, lead of electronic parts, etc. may cause an electric shock.

POINT

●Turning "ON (up)" all the control axis setting switches (SW2) enables an operation mode for manufacturer setting and displays "off". The mode is not available. Set the control axis setting switches (SW2) correctly according to this section.

●Cycling the main circuit power supply and control circuit power supply enables the setting of each switch.

The following shows the description of the axis selection rotary switch.

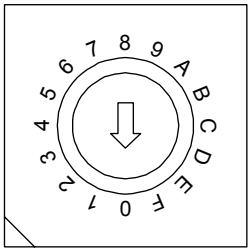

3-dight, 7-segment LED
Axis selection rotary switch (SW1)
Control axis setting switch (SW2)
(Not used in J2S compatibility mode.
Turn all switches "OFF (down)".)
ON
1 2 3 4

POINT

- The control axis No. set to the axis selection rotary switch (SW1) should be the same as the one set to the servo system controller. The number of the axes you can set depends on the servo system controller.
- For setting the axis selection rotary switch, use a flat-blade screwdriver with the blade edge width of 2.1 mm to 2.3 mm and the blade edge thickness of 0.6 mm to 0.7 mm.

Use the axis selection rotary switch (SW1) to set the control axis number for the servo.
If the same numbers are set to different control axes in a single communication system, the system will not operate properly. The control axes may be set independently of the SSCNET cable connection sequence.
Set the switch to "F" when performing the test operation mode by using MR Configurator.

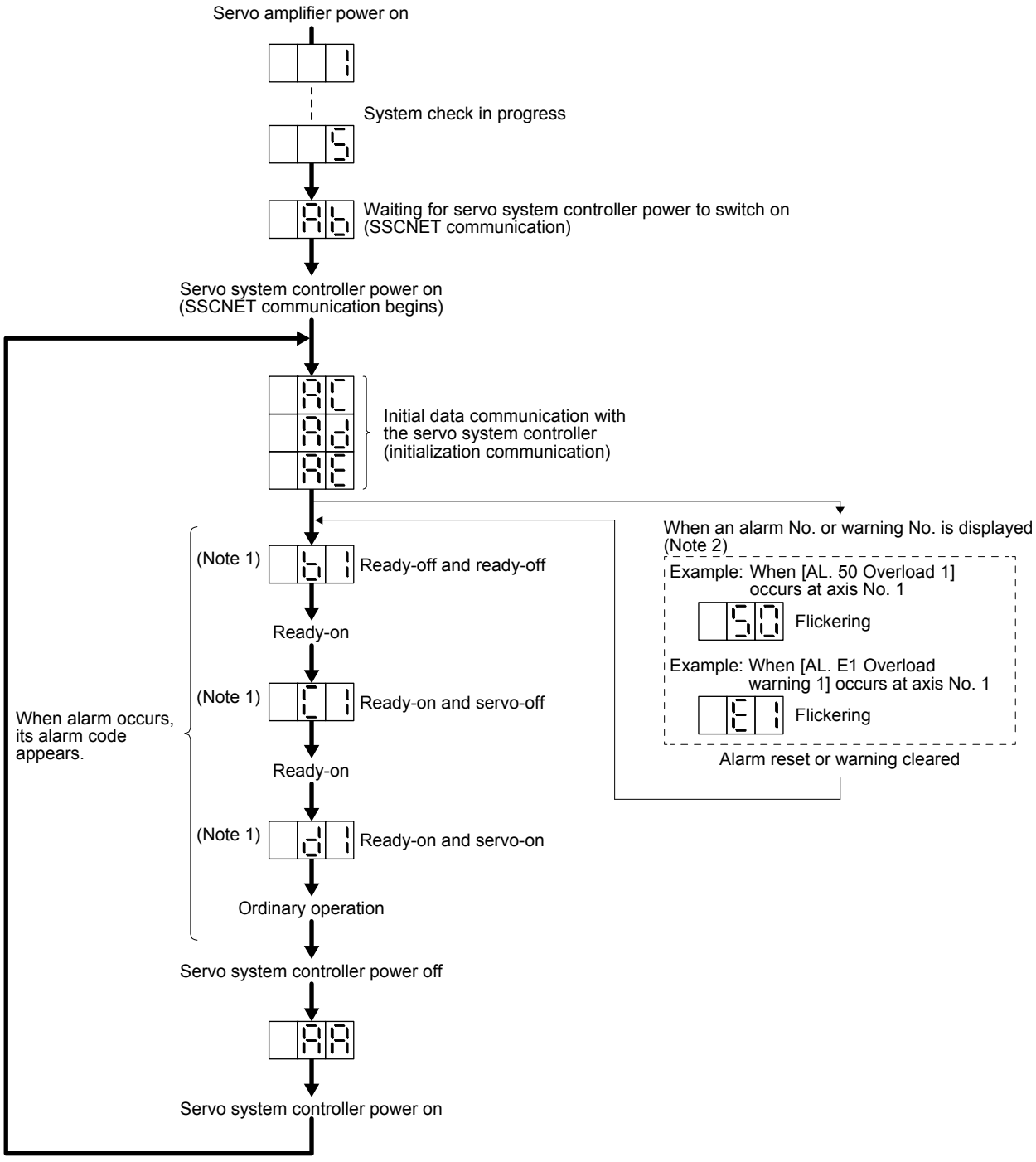
Axis selection rotary switch (SW1)

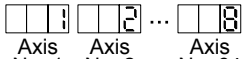


No.	Description
0	Axis No. 1
1	Axis No. 2
2	Axis No. 3
3	Axis No. 4
4	Axis No. 5
5	Axis No. 6
6	Axis No. 7
7	Axis No. 8
8	Not used in J2S compatibility mode.
9	
A	
B	
C	
D	
E	
F	Test operation mode or when a machine analyzer is used (Refer to section 6.1.2)

4.3.2 Status display of an axis

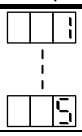
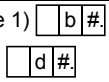
(1) Display sequence


Servo amplifier power on
System check in progress
Waiting for servo system controller power to switch on (SSCNET communication)
Servo system controller power on (SSCNET communication begins)
Initial data communication with the servo system controller (initialization communication)
When an alarm No. or warning No. is displayed (Note 2)
Example: When [AL. 50 Overload 1] occurs at axis No. 1
Flickering
Example: When [AL. E1 Overload warning 1] occurs at axis No. 1
Flickering
Alarm reset or warning cleared
(Note 1)
Ready-off and ready-off
Ready-on
(Note 1)
Ready-on and servo-off
Ready-on
(Note 1)
Ready-on and servo-on
Ordinary operation
When alarm occurs, its alarm code appears.
Servo system controller power off
Servo system controller power on

Note 1.  The segment of the last 1 digit shows the axis number.
Axis No. 1 Axis No. 2 ... Axis No. 64

2. The alarm No. or warning No. is displayed, but the axis No. is not displayed.

(2) Indication list

Display	Status	Description
	Initializing	System check in progress
	Initializing	・The servo amplifier power was switched on when the servo system controller power was off. ・The control axis No. set to the axis selection rotary switch (SW1) does not match the one set to the servo system controller. ・A servo amplifier malfunctioned, or communication error occurred with the servo system controller or the previous axis servo amplifier. In this case, the indication changes as follows: "Ab", "AC", "Ad", and "Ab" ・The servo system controller is malfunctioning.
	Initializing	Initial setting for communication specifications completed, and then it synchronized with servo system controller.
	Initializing	During initial parameter setting communication with servo system controller
	Initializing	During the servo motor/encoder information and telecommunication with servo system controller
	Initializing standby	The power supply of servo system controller was turned off while the power supply of servo amplifier is on.
(Note 1)	Ready-off	The ready-off command from the servo system controller was received.
(Note 1)	Servo-on	The servo-on command from the servo system controller was received.
(Note 1)	Servo-off	The servo-off command from the servo system controller was received.
(Note 2)	Alarm and warning	The alarm No. and the warning No. that occurred is displayed. (Refer to chapter 8.)
	CPU error	CPU watchdog error has occurred.
	(Note 3) Test operation mode	JOG operation, positioning operation, DO forced output, and program operation
(Note 1)  		Motor-less operation

Note 1. # denotes any of numerals 0 to 8 and what it means is listed below.

#	Description
0	Set to the test operation mode.
1 to 8	Axis No.1 to Axis No.8

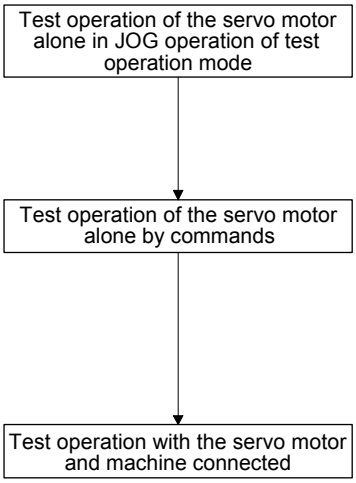
2. "**" indicates the alarm No. and the warning No.
3. For JOG operation, positioning operation, DO forced output and program operation, MR Configurator is necessary.

4.4 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally. Refer to section 4.2 for the power on and off methods of the servo amplifier.

POINT

- If necessary, verify controller program by using motor-less operation. Refer to section 4.5.2 for the motor-less operation.


Test operation of the servo motor alone in JOG operation of test operation mode
Test operation of the servo motor alone by commands
Test operation with the servo motor and machine connected

In this step, confirm that the servo amplifier and servo motor operate normally. With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor rotates correctly. Refer to section 4.5 for the test operation mode.

In this step, confirm that the servo motor rotates correctly under the commands from the controller.
Give a low speed command at first and check the rotation direction, etc. of the servo motor. If the machine does not operate in the intended direction, check the input signal.

In this step, connect the servo motor with the machine and confirm that the machine operates normally under the commands from the controller.
Give a low speed command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal.
Check any problems with the servo motor speed, load ratio, and other status display items with MR Configurator.
Then, check automatic operation with the program of the controller.

4.5 Test operation mode

⚠CAUTION

- The test operation mode is designed for checking servo operation. It is not for checking machine operation. Do not use this mode with the machine. Always use the servo motor alone.
- If the servo motor operates abnormally, use EM1 (Forced stop) to stop it.

POINT

- The content described in this section indicates that the servo amplifier and a personal computer are directly connected.

By using a personal computer and MR Configurator, you can execute JOG operation, positioning operation, DO forced output program operation without connecting the servo system controller.

4.5.1 Test operation mode in MR Configurator

POINT

●When you set the axis selection rotary switch (SW1) to "F", the SSCNET communication for the servo amplifier and the subsequent servo amplifiers is blocked.

(1) Test operation mode

(a) JOG operation

JOG operation can be performed without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on/off and whether the servo system controller is connected or not.

Exercise control on the JOG operation screen of MR Configurator.

1) Operation pattern

Item	Initial value	Setting range
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 20000

2) Operation method

Operation	Screen control
Forward rotation start	Click the "Forward" button.
Reverse rotation start	Click the "Reverse" button.
Stop	Click the "Stop" button.

(b) Positioning operation

Positioning operation can be performed without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on/off and whether the servo system controller is connected or not.

Exercise control on the positioning operation screen of MR Configurator.

1) Operation pattern

Item	Initial value	Setting range
Travel distance [pulse]	131072	0 to 9999999
Speed [r/min]	200	0 to max. speed
Acceleration/deceleration time constant [ms]	1000	0 to 20000

2) Operation method

Operation	Screen control
Forward rotation start	Click the "Forward" button.
Reverse rotation start	Click the "Reverse" button.
Pause	Click the "Pause" button.

(c) Program operation

Positioning operation can be performed in two or more operation patterns combined, without using the servo system controller. Use this operation with the forced stop reset. This operation may be used independently of whether the servo is on/off and whether the servo system controller is connected or not.

Exercise control on the program operation screen of MR Configurator. For full information, refer to the MR Configurator Installation Guide.

Operation	Screen control
Start	Click the "Start" button.
Stop	Click the "Reset" button.

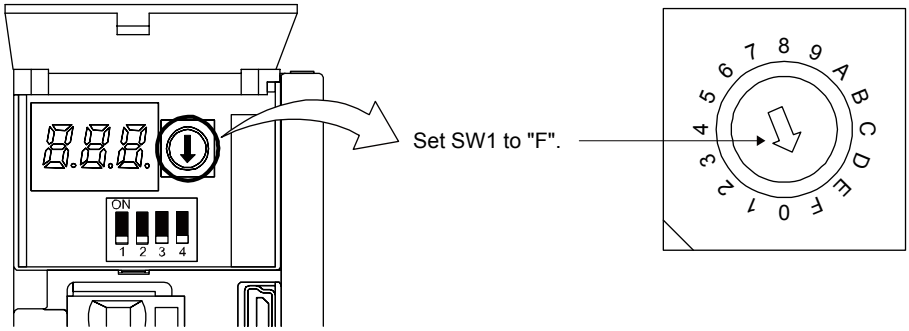
(d) Output signal (DO) forced output

Output signals can be switched on/off forcibly independently of the servo status. This function is used for output signal wiring check, etc. Exercise control on the DO forced output screen of MR Configurator.

(2) Operation procedure

1) Turn off the power.

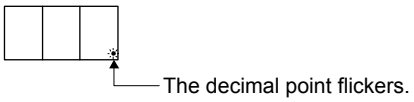
2) Set SW1 to "F".



Setting SW1 to"F" during power-on will not start the test operation mode.

3) Turn on the servo amplifier.

When initialization is completed, the decimal point on the first digit will flicker.



4) Start operation with the personal computer.

4.5.2 Motor-less operation in controller

POINT
●Motor-less operation cannot be used with MR Configurator. To use motor-less operation, set "_ 1 _ _" in [Pr. 24]. ●Use motor-less operation which is available by making the servo system controller parameter setting. ●Connect the servo system controller to the servo amplifier before the motor-less operation.

(1) Motor-less operation

Without connecting the servo motor to the servo amplifier, output signals or status displays can be provided in response to the servo system controller commands as if the servo motor is actually running. This operation may be used to check the servo system controller sequence. Use this operation with the forced stop reset. Use this operation with the servo system controller connected to the servo amplifier. To stop the motor-less operation, set the motor-less operation selection to "Disable" in the servo parameter setting of the servo system controller. When the power supply is turned on next time, motor-less operation will be disabled.

(a) Load conditions

Load item	Condition
Load torque	0
Load to motor inertia ratio	Same as the moment of inertia of the servo motor

(b) Alarms

The following alarms and warning do not occur. However, the other alarms and warnings occur as when the servo motor is connected.

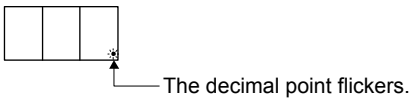
- [AL. 16 Encoder error 1]
- [AL. 20 Encoder error 2]
- [AL. 25 Absolute position erased]
- [AL. 92 Battery cable disconnection warning]
- [AL. 9F Battery warning]

(2) Operation procedure

1) Set the servo amplifier to the servo-off status.

2) Set "_ 1 _ _" in [Pr. 24] and turn off the servo amplifier power.

3) Turn on the servo amplifier.
When initialization is completed, the decimal point on the first digit will flicker.



4) Start the motor-less operation with the servo system controller.

5. PARAMETERS

⚠CAUTION

- Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.
- If fixed values are written in the digits of a parameter, do not change these values.
- Do not change parameters for manufacturer setting.
- Do not set a value other than the described values to each parameter.

POINT

- When you connect the amplifier to a servo system controller, servo parameter values of the servo system controller will be written to each parameter.
- Setting may not be made to some parameters and their ranges depending on the servo system controller model, servo amplifier software version, and MR Configurator software version. For details, refer to the servo system controller user's manual.

5.1 Parameter list

POINT

- The parameter whose symbol is preceded by * is enabled with the following conditions:
  *: After setting the parameter, cycle the power.

5.1.1 Basic setting parameters

No.	Symbol	Name	Initial value	Unit
1	*AMS	Amplifier setting	0000h	
2	*REG	Regenerative resistor	0000h	
3		Automatically set from the servo system controller	0080h	
4			0000h	
5			1	
6	*FBP	Feedback pulse number	0	
7	*POL	Rotation direction selection	0	
8	ATU	Auto tuning	0001h	
9	RSP	Servo response	7 kW or less: 0005h 11 kW or more: 0002h	
10	TLP	Forward rotation torque limit (Note)	300	[%]
11	TLN	Reverse rotation torque limit (Note)	300	[%]

Note. The programming software of motion controller cannot set or change this parameter.

5.1.2 Adjustment parameters

No.	Symbol	Name	Initial value	Unit
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)	7.0	[Multiplier]
13	PG1	Position loop gain 1	7 kW or less: 35 11 kW or more: 19	[rad/s]
14	VG1	Speed loop gain 1	7 kW or less: 177 11 kW or more: 96	[rad/s]
15	PG2	Position loop gain 2	7 kW or less: 35 11 kW or more: 19	[rad/s]
16	VG2	Speed loop gain 2	7 kW or less: 817 11 kW or more: 455	[rad/s]
17	VIC	Speed integral compensation	7 kW or less: 48 11 kW or more: 91	[ms]
18	NCH	Machine resonance suppression filter 1 (notch filter)	0000h	
19	FFC	Feed forward gain	0	[%]
20	INP	In-position range	100	[pulse]
21	MBR	Electromagnetic brake sequence output	0	[ms]
22	MOD	Analog monitor output	0001h	
23	*OP1	Option function 1	0000h	
24	*OP2	Option function 2	0000h	
25	LPF	Low-pass filter	0000h	
26		For manufacturer setting	0	

5.1.3 Extension parameters

No.	Symbol	Name	Initial value	Unit
27	MO1	Analog monitor 1 offset	0	[mV]
28	MO2	Analog monitor 2 offset	0	[mV]
29		For manufacturer setting	0001h	
30	ZSP	Zero speed	50	[r/min]
31	ERZ	Error excessive alarm level	8.0	[0.25 rev]
32	OP5	Option function 5	0000	
33	*OP6	Option function 6	0000	
34	VPI	PI-PID switching position droop	0	[pulse]
35		For manufacturer setting	0	
36	VDC	Speed differential compensation	980	
37		For manufacturer setting	0010h	
38	*ENR	Encoder output pulses	4000	[pulse/rev]
39	DBT	Electronic dynamic brake operating time	0	[ms]
40	*BLK	Parameter writing inhibit (Note 1)	0000h	
41		For manufacturer setting	500	
42			0000h	
43			0111h	
44			20	
45			50	
46			0	
47			0	
48			0	
49	*CDP	Gain switching selection	0000h	
50	CDS	Gain switching condition	10	[kpulse/s]/ [pulse]/ [r/min]
51	CDT	Gain switching time constant	1	[ms]
52	GD2B	Ratio of load inertia to servo motor inertia 2	7.0	[Multiplier]
53	PG2B	Position loop gain 2 change ratio	100	[%]
54	VG2B	Speed loop gain 2 change ratio	100	[%]
55	VICB	Speed integral compensation change ratio	100	[%]

No.	Symbol	Name	Initial value	Unit
56	*OP8	Option function 8	0000h	
57		For manufacturer setting	0000h	
58	*OPA	Option function A (Note 2)	0000h	
59		For manufacturer setting	0000h	
60	*OPC	Option function C	0000h	
61	NH2	Machine resonance suppression filter 2	0000h	
62		For manufacturer setting	0000h	
63			400	
64			100	
65			1	
66			1	
67			0	
68			0	
69			0	
70			0	
71			0	
72			0	
73			0	
74			0	
75			0	

Note 1. The programming software of motion controller cannot set or change this parameter.
2. Used by servo amplifiers with software version A1 or later.

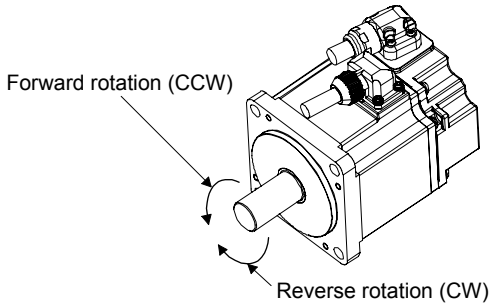
5.2 Detailed list of parameters

POINT
●Set a value to each "x" in the "Setting digit" columns.

5.2.1 Basic setting parameters

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>1</td><td>*AMS</td><td>Amplifier setting
Set this parameter when using the absolute position detection system.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Absolute position detection system selection
0: Disabled (used in incremental system)
1: Enabled (used in absolute position detection system)</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>2</td><td>*REG</td><td>Regenerative resistor
Select the regenerative option.
Incorrect setting may cause the regenerative option to burn. If a selected regenerative option is not for use with the servo amplifier, [AL. 37 Parameter error] occurs.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Regenerative option selection
00: Regenerative option is not used.
・For servo amplifier of 100 W, regenerative option is not used.
・For servo amplifier of 0.2 kW to 7 kW, built-in regenerative resistor is used.
・Supplied regenerative resistors or regenerative option is used with the servo amplifier of 11 kW to 22 kW.
01: FR-RC/FR-RC-H/FR-CV/FR-CV-H/FR-BU2/FR-BU2-H
05: MR-RB32
08: MR-RB30
09: MR-RB50 (Cooling fan is required.)
0B: MR-RB31
0C: MR-RB51 (Cooling fan is required.)
0E: When the supplied regenerative resistors are cooled by the cooling fan to increase the ability with the servo amplifier of 11 kW to 22 kW.
10: MR-RB032
11: MR-RB12
13: MR-RB5E
14: MR-RB5E (Cooling fan is required.)
17: MR-RB9F
18: MR-RB9F (Cooling fan is required.)
20: MR-RB3N
21: MR-RB5N (Cooling fan is required.)
23: MR-RB5R
24: MR-RB5R (Cooling fan is required.)
25: MR-RB9P
26: MR-RB9P (Cooling fan is required.)
27: MR-RB9T
28: MR-RB9T (Cooling fan is required.)
80: MR-RB3H-4 (Cooling fan is required.)
81: MR-RB5H-4 (Cooling fan is required.)
82: MR-RB3G-4 (Cooling fan is required.)
83: MR-RB5G-4 (Cooling fan is required.)
84: MR-RB34-4 (Cooling fan is required.)
85: MR-RB54-4 (Cooling fan is required.)
86: MR-RB1L-4
87: MR-RB3M-4 (Cooling fan is required.)
90: MR-RB1H-4
9C: MR-RB3U-4 (Cooling fan is required.)
9D: MR-RB5U-4 (Cooling fan is required.)</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td>External dynamic brake selection
0: Disabled
1: Enabled
When using an external dynamic brake with 11 kW or more servo amplifier, select "1".</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td>Refer to Name and function column.</td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>6</td><td>*FBP</td><td>Feedback pulse number
Set the number of pulses per revolution of the servo motor in the controller side command unit. Information on the servo motor such as the cumulative feedback pulses, current position, droop pulses and within-one-revolution position are derived from the values converted into the number of pulses set here.
If the number of pulses set exceeds the actual servo motor encoder resolution, the servo motor encoder resolution is automatically set.
<table><tr><th>Setting value</th><th>Feedback pulse number</th></tr><tr><td>0</td><td>16384</td></tr><tr><td>1</td><td>8192</td></tr><tr><td>6</td><td>32768</td></tr><tr><td>7</td><td>131072</td></tr><tr><td>255</td><td>Depending on the number of servo motor encoder resolution pulses</td></tr></table></td><td>0</td><td>Refer to Name and function column.</td></tr>
<tr><td>7</td><td>*POL</td><td>Rotation direction selection
Select the rotation direction of command input pulse.
<table><tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr><tr><th>Positioning address increase</th><th>Positioning address decrease</th></tr><tr><td>0</td><td>CCW</td><td>CW</td></tr><tr><td>1</td><td>CW</td><td>CCW</td></tr></table>The following shows the servo motor rotation directions.
 
</td><td>0</td><td>0
to
1</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>8</td><td>ATU</td><td>Auto tuning
Select the gain adjustment mode.

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Gain adjustment mode selection
0: Interpolation mode
1: Auto tuning mode 1
2: Manual mode 2
3: Auto tuning mode 2
4: Manual mode 1
Refer to table 5.1 for details.</td><td>1h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
Table 5.1 Gain adjustment mode selection
<table>
<tr><th>Setting value</th><th>Gain adjustment mode</th><th>Automatically adjusted parameter</th></tr>
<tr><td>_ _ _ 0</td><td>Interpolation mode</td><td>[Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)]
[Pr. 15 Position loop gain 2]
[Pr. 16 Speed loop gain 2]
[Pr. 17 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 1</td><td>Auto tuning
Mode 1</td><td>[Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)]
[Pr. 13 Position loop gain 1]
[Pr. 14 Speed loop gain 1]
[Pr. 15 Position loop gain 2]
[Pr. 16 Speed loop gain 2]
[Pr. 17 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 2</td><td>Manual mode 2</td><td></td></tr>
<tr><td>_ _ _ 3</td><td>Auto tuning
Mode 2</td><td>[Pr. 13 Position loop gain 1]
[Pr. 14 Speed loop gain 1]
[Pr. 15 Position loop gain 2]
[Pr. 16 Speed loop gain 2]
[Pr. 17 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 4</td><td>Manual mode1</td><td>[Pr. 14 Speed loop gain 1]
[Pr. 15 Position loop gain 2]</td></tr>
</table>
</td><td>Refer to Name and function column.</td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>9</td><td>RSP</td><td>Servo response
Set the auto tuning response.
If the machine hunts or generates large gear sound, decrease the set value.
To improve performance, e.g. shorten the settling time, increase the set value.

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Response level setting
Refer to table 5.2 for settings.</td><td>7 kW or less: 05h
11 kW or more: 02h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>

Table 5.2 Response level setting
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>1</td><td rowspan="8">Low response
↕
Middle response</td><td>15</td></tr>
<tr><td>2</td><td>20</td></tr>
<tr><td>3</td><td>25</td></tr>
<tr><td>4</td><td>30</td></tr>
<tr><td>5</td><td>35</td></tr>
<tr><td>6</td><td>45</td></tr>
<tr><td>7</td><td>55</td></tr>
<tr><td>8</td><td>70</td></tr>
</table>
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>9</td><td rowspan="8">Middle response
↕
High response</td><td>85</td></tr>
<tr><td>A</td><td>105</td></tr>
<tr><td>B</td><td>130</td></tr>
<tr><td>C</td><td>160</td></tr>
<tr><td>D</td><td>200</td></tr>
<tr><td>E</td><td>240</td></tr>
<tr><td>F</td><td>300</td></tr>
</table>
</td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>10</td><td>TLP</td><td>Forward rotation torque limit
Set the rated torque = 100%.
The parameter limits the torque in the forward rotation during power running and reverse rotation during regeneration.
In other than the test operation mode by MR Configurator, the torque limit value in the servo system controller is enabled.
To operate HG series servo motor at the maximum torque, set the torque limit value in the servo system controller at 500%. When the maximum torque is used in the test operation mode, set this parameter to 500%.</td><td>300 [%]</td><td>0 to 500</td></tr>
<tr><td>11</td><td>TLN</td><td>Reverse rotation torque limit
Set the rated torque = 100%.
The parameter limits the torque in reverse rotation during power running and forward rotation during regeneration.
In other than the test operation mode by MR Configurator, the torque limit value in the servo system controller is enabled.
To operate HG series servo motor at the maximum torque, set the torque limit value in the servo system controller at 500%. When the maximum torque is used in the test operation mode, set this parameter to 500%.</td><td>300 [%]</td><td>0 to 500</td></tr>
</table>

5.2.2 Adjustment parameters

No.	Symbol	Name and function	Initial value [unit]	Setting range
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio) Set the load moment of inertia to the moment of inertia on servo motor shaft (load inertia ratio). When auto tuning mode 1 or interpolation mode is selected, the result of auto tuning is automatically used. (Refer to section 6.1.1.)	7.0 [Multiplier]	0.0 to 300.0
13	PG1	Position loop gain 1 This is used to set the gain of the position loop. Increase the gain to improve track ability in response to the position command. When the auto turning mode 1 or auto turning mode 2 is selected, the result of auto turning is automatically used.	7 kW or less: 35 [rad/s] 11 kW or more: 19 [rad/s]	4 to 2000
14	VG1	Speed loop gain 1 Normally, changing this parameter is not required. Increasing the setting value will also increase the response level but will be liable to generate vibration and/or noise. When the auto tuning mode 1, auto tuning mode 2, or manual mode 1 is selected, the result of auto tuning is automatically used.	7 kW or less: 177 [rad/s] 11 kW or more: 96 [rad/s]	20 to 8000
15	PG2	Position loop gain 2 This is used to set the gain of the position loop. Set this parameter to increase the position response to level load disturbance. Increasing the setting value will also increase the response level but will be liable to generate vibration and/or noise. When auto tuning mode 1, auto tuning mode 2, manual mode 1, or interpolation mode is selected, the result of auto tuning is automatically used.	7 kW or less: 35 [rad/s] 11 kW or more: 19 [rad/s]	1 to 1000
16	VG2	Speed loop gain 2 Set this parameter when vibration occurs on machines of low rigidity or large backlash. Increasing the setting value will also increase the response level but will be liable to generate vibration and/or noise. When the auto tuning mode 1, auto tuning mode 2, or interpolation mode is selected, the result of auto tuning is automatically used.	7 kW or less: 817 [rad/s] 11 kW or more: 455 [rad/s]	20 to 20000
17	VIC	Speed integral compensation Set the time constant of the integral compensation. When the auto tuning mode 1, auto tuning mode 2, or interpolation mode is selected, the result of auto tuning is automatically used.	7 kW or less: 48 [ms] 11 kW or more: 91 [ms]	1 to 1000

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>18</td><td>NCH</td><td>Machine resonance suppression filter 1 (notch filter)
Select the machine resonance suppression filter. (Refer to section 7.1.1.)

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Notch frequency selection
Refer to table 5.3 for settings.</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>

Table 5.3 Notch frequency selection
<table>
<tr><th>Setting value</th><th>Frequency [Hz]</th><th>Setting value</th><th>Frequency [Hz]</th></tr>
<tr><td>00</td><td>Disabled</td><td>10</td><td>281.3</td></tr>
<tr><td>01</td><td>4500</td><td>11</td><td>264.7</td></tr>
<tr><td>02</td><td>2250</td><td>12</td><td>250</td></tr>
<tr><td>03</td><td>1500</td><td>13</td><td>236.8</td></tr>
<tr><td>04</td><td>1125</td><td>14</td><td>225</td></tr>
<tr><td>05</td><td>900</td><td>15</td><td>214.3</td></tr>
<tr><td>06</td><td>750</td><td>16</td><td>204.5</td></tr>
<tr><td>07</td><td>642.9</td><td>17</td><td>195.7</td></tr>
<tr><td>08</td><td>562.5</td><td>18</td><td>187.5</td></tr>
<tr><td>09</td><td>500</td><td>19</td><td>180</td></tr>
<tr><td>0A</td><td>450</td><td>1A</td><td>173.1</td></tr>
<tr><td>0B</td><td>409.1</td><td>1B</td><td>166.7</td></tr>
<tr><td>0C</td><td>375</td><td>1C</td><td>160.1</td></tr>
<tr><td>0D</td><td>346.2</td><td>1D</td><td>155.2</td></tr>
<tr><td>0E</td><td>321.4</td><td>1E</td><td>150</td></tr>
<tr><td>0F</td><td>300</td><td>1F</td><td>145.2</td></tr>
</table>
</td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>19</td><td>FFC</td><td>Feed forward gain
Set the feed forward gain.
When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1 s or more as the acceleration time constant up to the rated speed.</td><td>0
[%]</td><td>0
to
100</td></tr>
<tr><td>20</td><td>INP</td><td>In-position range
Set an in-position range per command pulse.</td><td>100
[pulse]</td><td>0
to
50000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>21</td><td>MBR</td><td>Electromagnetic brake sequence output
Set the delay time from MBR (Electromagnetic brake interlock) off to base circuit shut-off.</td><td>0
[ms]</td><td>0
to
1000</td></tr>
<tr><td>22</td><td>MOD</td><td>Analog monitor output
Select the signals to output to MO1 (Analog monitor 1) and MO2 (Analog monitor 2). Refer to appendix 6 (3) for detection point of output selection.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Analog monitor 2 output selection
Refer to table 5.4 for settings.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Analog monitor 1 output selection
Refer to table 5.4 for settings.</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>
Table 5.4 Analog monitor setting value
<table>
<tr><th>Setting value</th><th>Item</th></tr>
<tr><td>0</td><td>Servo motor speed (±8 V/max. speed)</td></tr>
<tr><td>1</td><td>Torque (±8 V/max. torque) (Note 1)</td></tr>
<tr><td>2</td><td>Servo motor speed (+8 V/max. speed)</td></tr>
<tr><td>3</td><td>Torque (+8 V/max. torque) (Note 1)</td></tr>
<tr><td>4</td><td>Current command (±8 V/max. current command)</td></tr>
<tr><td>5</td><td>Speed command (±8 V/max. speed)</td></tr>
<tr><td>6</td><td>Droop pulses (±10 V/1128 pulses) (Note 2)</td></tr>
<tr><td>7</td><td>Droop pulses (±10 V/2048 pulses) (Note 2)</td></tr>
<tr><td>8</td><td>Droop pulses (±10 V/8192 pulses) (Note 2)</td></tr>
<tr><td>9</td><td>Droop pulses (±10 V/32768 pulses) (Note 2)</td></tr>
<tr><td>A</td><td>Droop pulses (±10 V/131072 pulses) (Note 2)</td></tr>
<tr><td>B</td><td>Bus voltage (200 V class and 100 V class: +8 V/400 V, 400 V class: +8 V/800 V)</td></tr>
</table>
Note 1. 8 V is outputted at the maximum torque.
2. Encoder pulse unit</td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>23</td><td>*OP1</td><td>Option function 1
The servo forced stop function can be disabled.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Servo forced stop selection
0: Enabled (EM1 (Forced stop) is used.)
1: Disabled (EM1 (Forced stop) is not used.)</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Encoder cable communication method selection
0: Two-wire type
1: Four-wire type
Incorrect setting will result in [AL. 16 Encoder error 1].</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td>Refer to Name and function column.</td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>24</td><td>*OP2</td><td>Option function 2
Select the slight vibration suppression control and motor-less operation.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Slight vibration suppression control selection
0: Disabled
1: Enabled
To enable the slight vibration suppression control, select "Manual mode 2 (_ _ _ 2)" of "Gain adjustment mode selection" in [Pr. 8].</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Motor-less operation selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>25</td><td>LPF</td><td>Low-pass filter
Select the low-pass filter. (Refer to section 7.1.2.)
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Low-pass filter selection
0: Enabled (automatic tuning)
1: Disabled
When enabled, the filter band in the following equation is automatically set.
For 1 kW or less
$\frac{\text{VG2 setting value} \times 10}{2\pi \times (1 + \text{GD2 setting value} \times 0.1)}$ [Hz]
For 2 kW or more
$\frac{\text{VG2 setting value} \times 5}{2\pi \times (1 + \text{GD2 setting value} \times 0.1)}$ [Hz]</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>(This servo amplifier is not compatible with adaptive vibration suppression control.)</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

5.2.3 Extension parameters

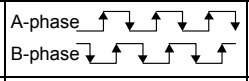
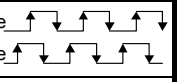
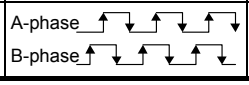
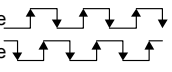
No.	Symbol	Name and function	Initial value [Unit]	Setting range
27	MO1	Analog monitor 1 offset Set the offset voltage of MO1 (Analog monitor 1).	0 [mV]	-999 to 999
28	MO2	Analog monitor 2 offset Set the offset voltage of MO2 (Analog monitor 2).	0 [mV]	-999 to 999
30	ZSP	Zero speed Set the output range of zero speed command sent to the controller.	50 [r/min]	0 to 10000
31	ERZ	Error excessive alarm level Set the range for [AL. 52 Error excessive] to occur.	8.0 [0.25 rev]	0.1 to 100.0

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>32</td><td>*OP5</td><td>Option function 5
Select the PI-PID switching control.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>PI-PID switching control selection
0: Continuous PI control enabled
1: Droop-based switching is valid in the position control mode. (Refer to [Pr. 34].)
2: Continuous PID control enabled
If the servo motor at a stop is rotated even one pulse due to any external factor, it generates torque to compensate for a position shift. When the servo motor shaft is to be locked mechanically after positioning completion (stop), switching on the PC (Proportion control) upon positioning completion will suppress the unnecessary torque generated to compensate for a position shift.</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>33</td><td>*OP6</td><td>Option function 6
Set the serial communication baud rate selection, serial communication response delay time, and encoder output pulse setting selection.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Serial communication baud rate selection
0: 9600 [bps]
1: 19200 [bps]
2: 38400 [bps]
3: 57600 [bps]</td><td>0h</td></tr><tr><td>_ _ x _</td><td>Serial communication response delay time
0: Disabled
1: Enabled (responding after 800 μs or more delay time)</td><td>0h</td></tr><tr><td>_ x _ _</td><td>Encoder output pulse setting selection (Refer to [Pr. 38].)
0: Output pulse specification
1: Division ratio setting</td><td>0h</td></tr><tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>34</td><td>VPI</td><td>PI-PID switching position droop
Set the position droop value (the number of pulses) at which PI control is switched over to PID control.
Setting "0 0 0 1" in [Pr. 32] enables this parameter.</td><td>0 or less [pulse]</td><td>0 to 50000</td></tr>
<tr><td>36</td><td>VDC</td><td>Speed differential compensation
This is used to set the differential compensation.</td><td>980</td><td>0 to 1000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>38</td><td>*ENR</td><td>Encoder output pulses
Set the encoder pulses (A-phase and B-phase) output by the servo amplifier. Set the four-fold value of the A-phase and B-phase pulses.
You can use [Pr. 33] to choose the output pulse setting or output dividing ratio setting.
The number of A-phase and B-phase pulses actually output is one fourth of the preset number of pulses.
The maximum output frequency is 1.3 Mpulses/s (after multiplication by four). Use this parameter within this range.
1. For output pulse designation
Set "_ 0 _ _ (initial value)" in [Pr. 33].
Set the number of pulses per servo motor revolution.
Output pulse = Setting value [pulse/rev]
For instance, when "5600" is set, the actual A/B-phase output pulses are as indicated below.
A-phase and B-phase output pulses = 5600/4 = 1400 [pulse]
2. For output dividing ratio setting
Set "_ 1 _ _" in [Pr. 33].
The number of pulses per servo motor revolution is divided by the set value.
Output pulse = Encoder resolution per servo motor revolution/Setting value [pulse/rev]
For instance, when "8" is set, the actual A/B-phase output pulses are as indicated below.
A-phase and B-phase pulses = 131072/8 x 1/4 = 4069 [pulse]</td><td>4000 [pulse/ rev]</td><td>0 to 65535</td></tr>
<tr><td>39</td><td>DBT</td><td>Electronic dynamic brake operating time
Set an operating time for the electronic dynamic brake.
However, when "0" is set, the operating time is 2000 ms.</td><td>0 [ms]</td><td>0 to 10000</td></tr>
<tr><td>40</td><td>*BLK</td><td>Parameter writing inhibit
Select a reference range and writing range of the parameter.
Refer to table 5.5 for settings.

Table 5.5 [Pr. 40] setting value and reading/writing range
<table><tr><th>Pr. 40</th><th>Setting operation</th><th>Operation from controller</th><th>Operation from MR Configurator</th></tr><tr><td rowspan="2">0000h (initial value)</td><td>Reading</td><td rowspan="12">[Pr. 1] to [Pr. 75]</td><td rowspan="2">[Pr. 1] to [Pr. 11], [Pr. 40]</td></tr><tr><td>Writing</td></tr><tr><td rowspan="2">000Ah</td><td>Reading</td><td rowspan="2">[Pr. 40]</td></tr><tr><td>Writing</td></tr><tr><td rowspan="2">000Ch</td><td>Reading</td><td>[Pr. 1] to [Pr. 40]</td></tr><tr><td>Writing</td><td>[Pr. 1] to [Pr. 11], [Pr. 40]</td></tr><tr><td rowspan="2">000Eh</td><td>Reading</td><td rowspan="2">[Pr. 1] to [Pr. 40]</td></tr><tr><td>Writing</td></tr><tr><td rowspan="2">000Fh</td><td>Reading</td><td rowspan="2">[Pr. 1] to [Pr. 75]</td></tr><tr><td>Writing</td></tr><tr><td rowspan="2">100Eh</td><td>Reading</td><td>[Pr. 1] to [Pr. 40]</td></tr><tr><td>Writing</td><td>[Pr. 40]</td></tr></table></td><td>0000h</td><td>Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>49</td><td>*CDP</td><td>Gain switching selection
Select the gain switching condition. (Refer to section 7.2.)
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Gain switching selection
The gain is changed depending on the setting value of [Pr. 52] to [Pr. 55] with the following conditions.
0: Disabled
1: Control command from controller
2: Command frequency is the [Pr. 50] setting value or more.
3: Droop pulses is the [Pr. 50] setting value or more.
4: Servo motor speed is the [Pr. 50] setting value or more.</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>50</td><td>CDS</td><td>Gain switching condition
Set the value of gain switching (command frequency, droop pulses, or servo motor speed) selected in [Pr. 49].
The set value unit differs depending on the switching condition item. (Refer to section 7.2.)</td><td>10
[kpulse/s]
/[pulse]
/[r/min]</td><td>0
to
9999</td></tr>
<tr><td>51</td><td>CDT</td><td>Gain switching time constant
Set the time constant at which the gains will change in response to the conditions set in [Pr. 49] and [Pr. 50]. (Refer to section 7.2.)</td><td>1
[ms]</td><td>0
to
100</td></tr>
<tr><td>52</td><td>GD2B</td><td>Ratio of load inertia to servo motor inertia 2
Set the load to motor inertia ratio when gain switching is enabled.</td><td>7.0
[Multiplier]</td><td>0.0
to
300.0</td></tr>
<tr><td>53</td><td>PG2B</td><td>Position loop gain 2 change ratio
Set the change ratio against position loop gain 2 when gain switching is enabled. Enabled when the auto tuning is disabled.</td><td>100
[%]</td><td>10
to
200</td></tr>
<tr><td>54</td><td>VG2B</td><td>Speed loop gain 2 change ratio
Set the change ratio against speed loop gain 2 when gain switching is enabled. Enabled when the auto tuning is disabled.</td><td>100
[%]</td><td>10
to
200</td></tr>
<tr><td>55</td><td>VICB</td><td>Speed integral compensation change ratio
Set the change ratio against speed integral compensation when gain switching is enabled. Enabled when the auto tuning is disabled.</td><td>100
[%]</td><td>50
to
1000</td></tr>
<tr><td>56</td><td>*OP8</td><td>Option function 8
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>Electronic dynamic brake selection
0: Automatic (enabled only for specified servo motors)
2: Disabled
Refer to the following table for the specified servo motors.
<table><tr><th>Series</th><th>Servo motor</th></tr><tr><td>HG-KR</td><td>HG-KR053/HG-KR13/HG-KR23/HG-KR43</td></tr><tr><td>HG-MR</td><td>HG-MR053/HG-MR13/HG-MR23/HG-MR43</td></tr><tr><td>HG-SR</td><td>HG-SR51/HG-SR52</td></tr></table></td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>58</td><td>*OPA</td><td>Option function A
This is used to select enabled or disabled for the thermistor of the servo motor.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Servo motor thermistor enabled/disabled selection
0: Enabled
1: Disabled
For servo motors without thermistor, the setting will be disabled.
This parameter is used by servo amplifier with software version A1 or later.</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>60</td><td>*OPC</td><td>Option function C
Select the encoder output pulse setting.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>0h</td></tr><tr><td>_ x _ _</td><td>Encoder output pulse phase selection
0: Increasing A-phase 90° in CCW
1: Increasing A-phase 90° in CW
<table><tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr><tr><th>CCW</th><th>CW</th></tr><tr><td>0</td><td>  </td><td>  </td></tr><tr><td>1</td><td>  </td><td>  </td></tr></table></td><td>0h</td></tr><tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>61</td><td>NH2</td><td>Machine resonance suppression filter 2
Select the machine resonance suppression filter 2. (Refer to section 7.1.1.)

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Notch frequency selection
Refer to table 5.6 for settings.</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table>

Table 5.6 Notch frequency selection
<table>
<tr><th>Setting value</th><th>Frequency [Hz]</th><th>Setting value</th><th>Frequency [Hz]</th></tr>
<tr><td>00</td><td>Disabled</td><td>10</td><td>281.3</td></tr>
<tr><td>01</td><td>4500</td><td>11</td><td>264.7</td></tr>
<tr><td>02</td><td>2250</td><td>12</td><td>250</td></tr>
<tr><td>03</td><td>1500</td><td>13</td><td>236.8</td></tr>
<tr><td>04</td><td>1125</td><td>14</td><td>225</td></tr>
<tr><td>05</td><td>900</td><td>15</td><td>214.3</td></tr>
<tr><td>06</td><td>750</td><td>16</td><td>204.5</td></tr>
<tr><td>07</td><td>642.9</td><td>17</td><td>195.7</td></tr>
<tr><td>08</td><td>562.5</td><td>18</td><td>187.5</td></tr>
<tr><td>09</td><td>500</td><td>19</td><td>180</td></tr>
<tr><td>0A</td><td>450</td><td>1A</td><td>173.1</td></tr>
<tr><td>0B</td><td>409.1</td><td>1B</td><td>166.7</td></tr>
<tr><td>0C</td><td>375</td><td>1C</td><td>160.1</td></tr>
<tr><td>0D</td><td>346.2</td><td>1D</td><td>155.2</td></tr>
<tr><td>0E</td><td>321.4</td><td>1E</td><td>150</td></tr>
<tr><td>0F</td><td>300</td><td>1F</td><td>145.2</td></tr>
</table>
</td><td>Refer to Name and function column.</td><td></td></tr>
</table>

MEMO

6. NORMAL GAIN ADJUSTMENT

POINT

- In the torque control mode, you do not need to make gain adjustment.
- Before making gain adjustment, check that your machine is not being operated at maximum torque of the servo motor. If operated over maximum torque, the machine may vibrate and may operate unexpectedly. Make gain adjustment with a safety margin considering characteristic differences of each machine. It is recommended that generated torque during operation is under 90% of the maximum torque of the servo motor.
- When using [Pr. 13 Position loop gain 1] of MR-J4-_B_-RJ020 and MR-J2S-_B_ simultaneously such as in the interpolation mode, check droop pulses for each axis and readjust gains.

6.1 Different adjustment methods

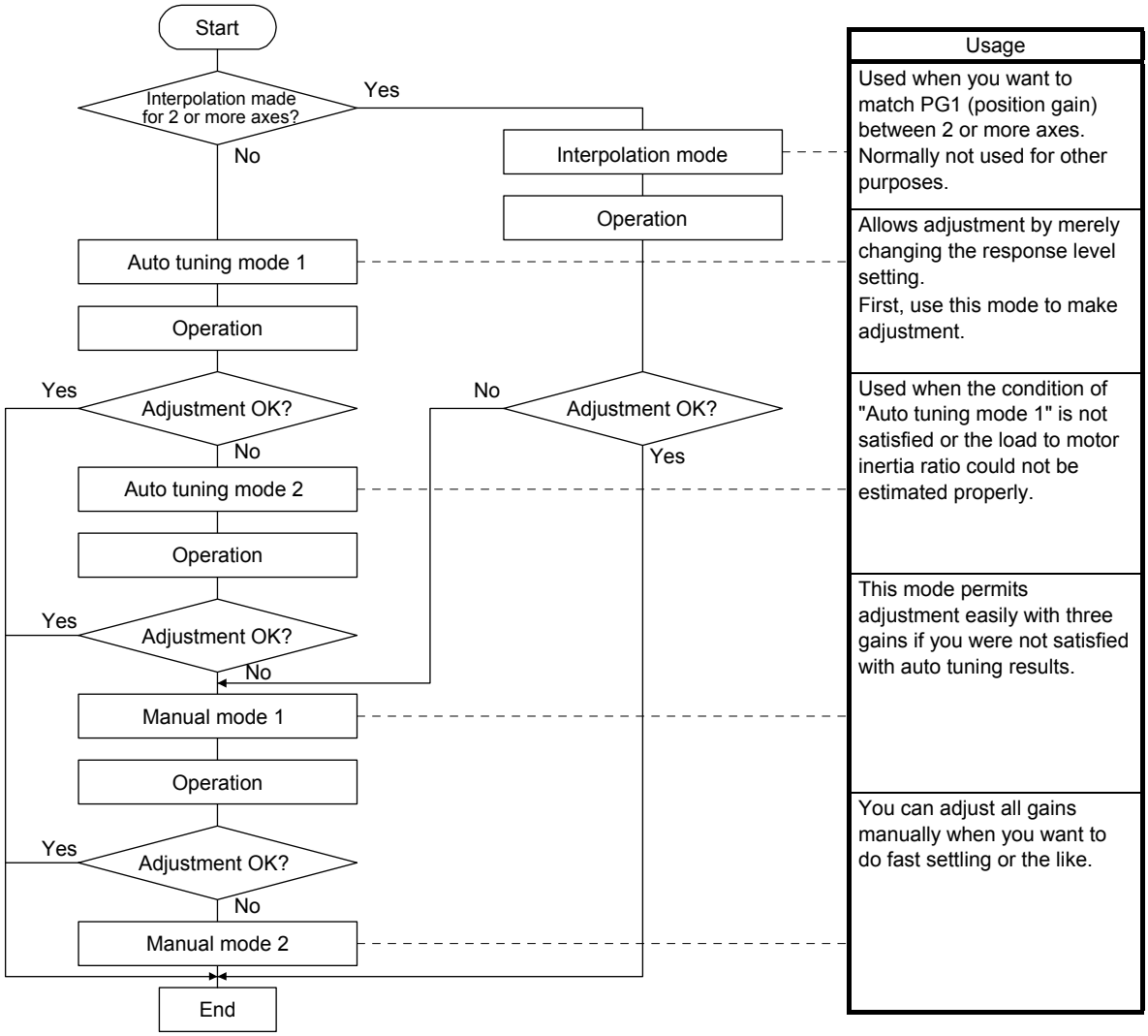
6.1.1 Adjustment on a single servo amplifier

The following shows the gain adjustment modes that can be set on a single servo amplifier. For gain adjustment, first execute "Auto tuning mode 1". If you are not satisfied with the result of the adjustment, execute "Auto tuning mode 2", "Manual mode 1" and "Manual mode2" in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	[Pr. 8] setting	Estimation of load to motor inertia ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	_ _ _ 1	Always estimated	GD2 ([Pr. 12]) PG1 ([Pr. 13]) VG1 ([Pr. 14]) PG2 ([Pr. 15]) VG2 ([Pr. 16]) VIC ([Pr. 17])	RSP ([Pr. 9])
Auto tuning mode 2	_ _ _ 3	Fixed to [Pr. 12] value	PG1 ([Pr. 13]) VG1 ([Pr. 14]) PG2 ([Pr. 15]) VG2 ([Pr. 16]) VIC ([Pr. 17])	GD2 ([Pr. 12]) RSP ([Pr. 9])
Manual mode 1	_ _ _ 4		VG1 ([Pr. 14]) PG2 ([Pr. 15])	GD2 ([Pr. 12]) PG1 ([Pr. 13]) VG2 ([Pr. 16]) VIC ([Pr. 17])
Manual mode 2	_ _ _ 2			GD2 ([Pr. 12]) PG1 ([Pr. 13]) VG1 ([Pr. 14]) PG2 ([Pr. 15]) VG2 ([Pr. 16]) VIC ([Pr. 17])
Interpolation mode	_ _ _ 0	Always estimated	GD2 ([Pr. 12]) PG2 ([Pr. 15]) VG2 ([Pr. 16]) VIC ([Pr. 17])	PG1 ([Pr. 13]) VG1 ([Pr. 14])

(2) Adjustment sequence and mode usage


Start
Interpolation made for 2 or more axes?
Yes
No
Interpolation mode
Operation
Auto tuning mode 1
Operation
Yes
Adjustment OK?
No
No
Adjustment OK?
Yes
Auto tuning mode 2
Operation
Yes
Adjustment OK?
No
Manual mode 1
Operation
Yes
Adjustment OK?
No
Manual mode 2
End
Usage
Used when you want to match PG1 (position gain) between 2 or more axes. Normally not used for other purposes.
Allows adjustment by merely changing the response level setting.
First, use this mode to make adjustment.
Used when the condition of "Auto tuning mode 1" is not satisfied or the load to motor inertia ratio could not be estimated properly.
This mode permits adjustment easily with three gains if you were not satisfied with auto tuning results.
You can adjust all gains manually when you want to do fast settling or the like.

6.1.2 Adjustment using MR Configurator

POINT
●When using the machine analyzer, set the axis No. of servo amplifier to "F". (Refer to section 4.3.1.)

This section explains the functions and adjustment using the servo amplifier with MR Configurator.

Function	Description	Adjustment
Machine analyzer	With the machine and servo motor coupled, the characteristic of the mechanical system can be measured by giving a random vibration command from a personal computer to the servo and measuring the machine response.	・You can grasp the machine resonance frequency and determine the notch frequency of the machine resonance suppression filter. ・You can automatically set the optimum gains in response to the machine characteristic. This simple adjustment is suitable for a machine which has large machine resonance and does not require much settling time.

6.2 Auto tuning

6.2.1 Auto tuning mode

The servo amplifier has a real-time auto tuning function which estimates the machine characteristic (load to motor inertia ratio) in real time and automatically sets the optimum gains according to that value. This function permits ease of gain adjustment of the servo amplifier.

(1) Auto tuning mode 1

The servo amplifier is factory-set to "Auto tuning mode 1".

In this mode, the load to motor inertia ratio of a machine is always estimated to set the optimum gains automatically.

The following parameters are automatically adjusted in "Auto tuning mode 1".

Parameter	Symbol	Name
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)
13	PG1	Position loop gain 1
14	VG1	Speed loop gain 1
15	PG2	Position loop gain 2
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

POINT
●"Auto tuning mode 1" may not be performed properly if all of the following conditions are not satisfied. ・The acceleration/deceleration time constant to reach 2000 r/min is 5 s or less. ・Speed is 150 r/min or higher. ・The load to motor inertia ratio is 100 times or less. ・The acceleration/deceleration torque is 10% or more of the rated torque. ●Under operating conditions which will impose sudden disturbance torque during acceleration/deceleration or on a machine which is extremely loose, auto tuning may not function properly, either. In such cases, use "Auto tuning mode 2", "Manual mode 1" or "Manual mode 2" to make gain adjustment.

(2) Auto tuning mode 2

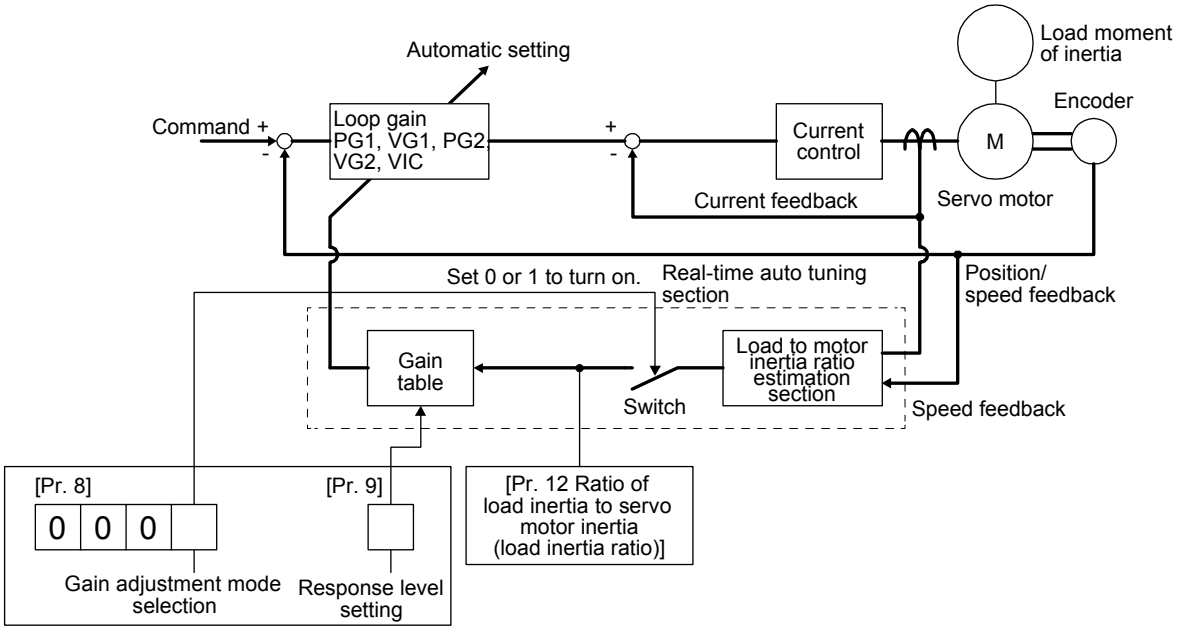
Use "Auto tuning mode 2" when proper gain adjustment cannot be made by "Auto tuning mode 1". Since the load to motor inertia ratio is not estimated in this mode, set the value of a correct load to motor inertia ratio in [Pr. 12].

The following parameters are automatically adjusted in "Auto tuning mode 2".

Parameter	Symbol	Name
13	PG1	Position loop gain 1
14	VG1	Speed loop gain 1
15	PG2	Position loop gain 2
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

6.2.2 Auto tuning mode basis

The block diagram of real-time auto tuning is shown below.



When a servo motor is accelerated/decelerated, the load to motor inertia ratio estimation section always estimates the load to motor inertia ratio from the current and speed of the servo motor. The results of estimation are written to [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio). These results can be confirmed on the status display screen of the MR Configurator.

If you have already known the value of the load to motor inertia ratio or failed to estimate, set "Gain adjustment mode selection" to "Auto tuning mode 2 (_ _ _ 3)" in [Pr. 8] to stop the estimation (turning off the switch in the above diagram), and set the load to motor inertia ratio ([Pr. 12]) manually.

From the preset load to motor inertia ratio ([Pr. 12]) value and response ([Pr. 9]), the optimum loop gains are automatically set on the basis of the internal gain table.

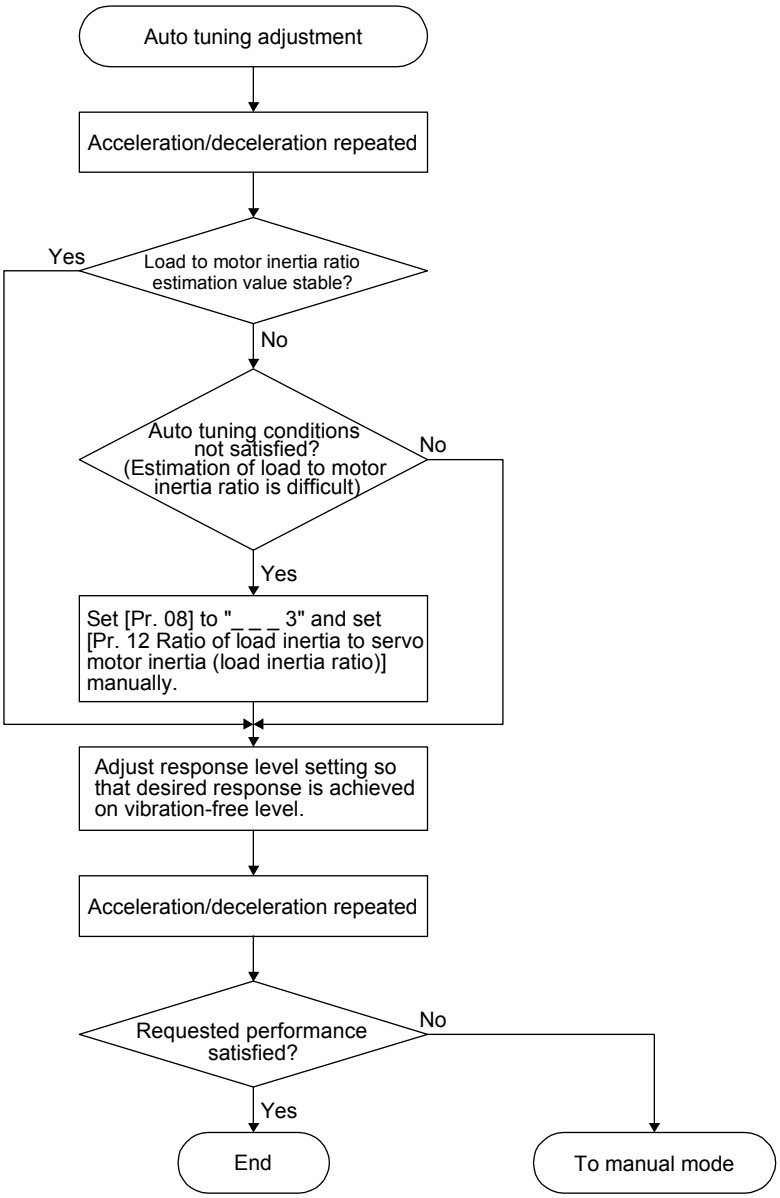
The auto tuning results are saved in the motion controller about every 10 s since power-on. At power-on, auto tuning is performed with the value of each loop gain saved in the motion controller being used as an initial value.

POINT

- If sudden disturbance torque is imposed during operation, the load to motor inertia ratio may be misestimated temporarily. In such a case, set "Gain adjustment mode selection" to "Auto tuning mode 2 (_ _ _ 3)" in [Pr. 8] and then set the correct load to motor inertia ratio in [Pr. 12].
- When any of "Auto tuning mode 1", "Auto tuning mode 2" or "Manual mode 1" settings is changed to the manual mode setting, the current loop gains and load to motor inertia ratio estimation value are saved in the EEP-ROM.

6.2.3 Adjustment procedure by auto tuning

Since auto tuning is enabled before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.


Auto tuning adjustment
Acceleration/deceleration repeated
Load to motor inertia ratio estimation value stable?
Yes
No
Auto tuning conditions not satisfied? (Estimation of load to motor inertia ratio is difficult)
No
Yes
Set [Pr. 08] to "_ _ _ 3" and set [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)] manually.
Adjust response level setting so that desired response is achieved on vibration-free level.
Acceleration/deceleration repeated
Requested performance satisfied?
No
Yes
End
To manual mode

6.2.4 Response level setting in auto tuning mode

Set the response of the whole servo system by [Pr. 9]. As the response level setting is increased, the track ability and settling time for a command decreases, but a too high response level will generate vibration. Hence, make setting until desired response is obtained within the vibration-free range.
If the response level setting cannot be increased up to the desired response because of machine resonance beyond 100 Hz, [Pr. 18 Machine resonance suppression filter 1 (notch filter)] may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. For changing the setting value of the machine resonance suppression filter, refer to 7.1.1.

[Pr. 9]

Setting value	Machine characteristic	
	Response	Guideline for machine resonance frequency [Hz]
1	Low response	15
2		20
3		25
4		30
5		35
6		45
7		55
8	Middle response	70
9		85
A		105
B		130
C		160
D		200
E		240
F	High response	300

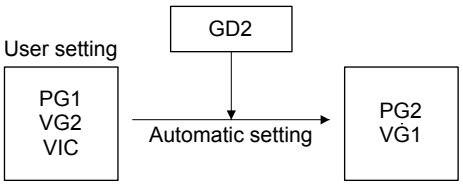
6.3 Manual mode 1 (simple manual adjustment)

If you are not satisfied with the adjustment of auto tuning, you can make manual adjustment with all gains.

> POINT
>
> ●If the machine resonance occurs, you can suppress the machine resonance with [Pr. 18 Machine resonance suppression filter 1 (notch filter)]. (Refer to section 7.1.1.)

6.3.1 Manual mode 1 basis

In this mode, setting of three gains of PG1 (position loop gain 1), VG2 (speed loop gain 2) and VIC (speed integral compensation) automatically sets the other gains to the optimum values according to these gains.



Therefore, you can adjust the model adaptive control system in the same image as the general PI control systems (position gain, speed gain and speed integral time constant). Here, the position corresponds to PG1, speed gain to VG2 and speed integral compensation time constant to VIC. When you adjust the gain with this mode, set [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)] properly.

6.3.2 Adjustment by manual mode 1

(1) For speed control

(a) Parameter

The following parameters are used for gain adjustment.

Parameter	Symbol	Name
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.2.3.	
2	Change the setting of auto tuning to the manual mode 2 ([Pr. 8]: _ _ _ 2).	
3	Set an estimated value in [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)].	
4	Increase the [Pr. 16 Speed loop gain 2] within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
5	Decrease the [Pr. 17 Speed integral compensation] within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
6	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with the machine resonance suppression filter and then executing steps 4 and 5.	Suppression of machine resonance Refer to section 7.1.1.
7	While checking the motor status, fine-adjust each gain.	Fine adjustment

(c) Parameter adjustment

1) [Pr. 16 Speed loop gain 2]

This parameter determines the response level of the speed control loop. Increasing the setting increases the response level, but the mechanical system is liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency [Hz]} = \frac{\text{Speed loop gain 2}}{(1 + \text{Load to motor inertia ratio}) \times 2\pi}$$

2) [Pr. 17 Speed integral compensation]

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load to motor inertia ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting [ms]} \geq \frac{2000 \text{ to } 3000}{\text{Speed loop gain 2}/(1 + \text{Load to motor inertia ratio})}$$

(2) For position control

(a) Parameter

The following parameters are used for gain adjustment.

Parameter	Symbol	Name
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)
13	PG1	Position loop gain 1
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 6.2.3.	
2	Change the setting of auto tuning to the manual mode 2 ([Pr. 8]: _ _ _ 2).	
3	Set an estimated value in [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)].	
4	Set a slightly smaller value in [Pr. 13 Position loop gain 1].	
5	Increase the [Pr. 16 Speed loop gain 2] within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the [Pr. 17 Speed integral compensation] within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the [Pr. 13 Position loop gain 1], and return slightly if vibration takes place.	Increase the position loop gain.
8	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with the machine resonance suppression filter and then executing steps 5 to 7.	Suppression of machine resonance Refer to section 7.1.1.
9	While checking the settling characteristic and motor status, fine-adjust each gain.	Fine adjustment

(c) Parameter adjustment

1) [Pr. 16 Speed loop gain 2]

This parameter determines the response level of the speed control loop. Increasing the setting increases the response level, but the mechanical system is liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency [Hz]} = \frac{\text{Speed loop gain 2}}{(1 + \text{Load to motor inertia ratio}) \times 2\pi}$$

2) [Pr. 17 Speed integral compensation]

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load to motor inertia ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting [ms]} \geq \frac{\text{2000 to 3000}}{\text{Speed loop gain 2}/(1 + \text{Load to motor inertia ratio})}$$

3) [Pr. 13 Position loop gain 1]

This parameter determines the response level to a disturbance to the position control loop. Increasing the position loop gain 1 increases the response level to a disturbance, but the mechanical system is liable to vibrate.

$$\text{Position loop gain 1 guideline} \leq \frac{\text{Speed loop gain 2}}{(1 + \text{Load to motor inertia ratio}) \times 2\pi} \times \frac{\text{Speed loop gain 2}}{(1 + \text{Load to motor inertia ratio})} \left(\frac{1}{3} \text{ to } \frac{1}{5}\right)$$

6.4 Interpolation mode

The interpolation mode is used to match the position loop gains of the axes when performing the interpolation operation of servo motors of two or more axes for an X-Y table or the like. In this mode, manually set the position loop gain 1 and speed loop gain 1 that determine command track ability. Other parameters for gain adjustment are set automatically.

(1) Parameter

(a) Automatically adjusted parameter

The following parameters are automatically adjusted by auto tuning.

Parameter	Symbol	Name
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)
15	PG2	Position loop gain 2
16	VG2	Speed loop gain 2
17	VIC	Speed integral compensation

(b) Manually adjusted parameter

The following parameters are adjustable manually.

Parameter	Symbol	Name
13	PG1	Position loop gain 1
14	VG1	Speed loop gain 1

(2) Interpolation mode adjustment procedure

Step	Operation	Description
1	Set the auto tuning mode 1 ([Pr. 8: _ _ _ 1]) and machine resonance frequency of response level to 15 Hz ([Pr. 9: _ _ _ 1]).	Select the auto tuning mode 1.
2	During operation, increase the response level setting value in [Pr. 9], and return the setting if vibration occurs.	Adjustment in the auto tuning mode 1
3	Check the values of [Pr. 13 Position loop gain 1] and [Pr. 14 Speed loop gain 1].	Check the upper setting limits.
4	Set to the interpolation mode ([Pr. 8: _ _ _ 0]).	Select the interpolation mode.
5	Set the position loop gain 1 of all the axes to be interpolated to the same value. At that time, adjust to the setting value of the axis, which has the smallest position loop gain 1.	Set the position loop gain 1.
6	Considering the speed loop gain 1 value you checked in step 3 as a upper limit guideline, set not less than three times the position loop gain 1 setting value while checking the servo motor movement.	Set the speed loop gain 1.
7	While checking the interpolation characteristic and the motor status, fine-adjust the gains and response level setting.	Fine adjustment

(3) Parameter adjustment

(a) [Pr. 13 Position loop gain 1]

This parameter determines the response level of the position control loop. Increasing the position loop gain 1 improves track ability to a position command, but a too high value will make overshoot liable to occur at settling. The droop pulse value is determined by the following expression.

$$\text{Number of droop pulses [pulse]} = \frac{\frac{\text{Speed [r/min]}}{60} \times 131072 \text{ [pulse]}}{\text{Position loop gain 1 setting}}$$

(b) [Pr. 14 Speed loop gain 1]

Set the response of the model speed loop. Set the values by referring to the following expression.

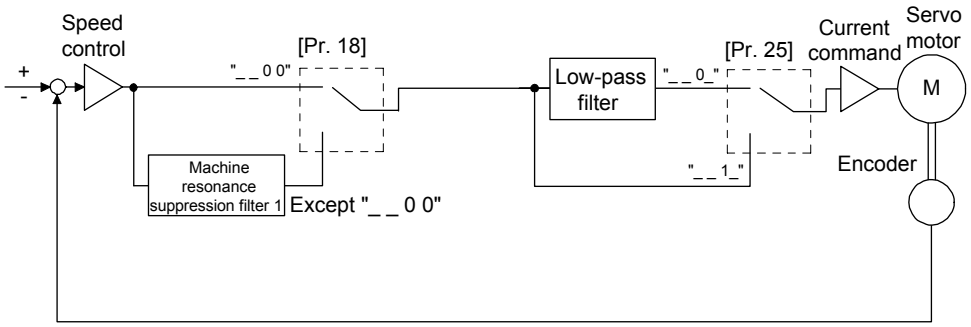
Speed loop gain 1 setting value ≥ Position loop gain 1 setting value × 3

7. SPECIAL ADJUSTMENT FUNCTIONS

POINT

- The functions given in this chapter need not be used normally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 6.
- MR-J4-_B_-RJ020 servo amplifier is not compatible with the adaptive vibration suppression control.

7.1 Filter setting



7.1.1 Machine resonance suppression filter

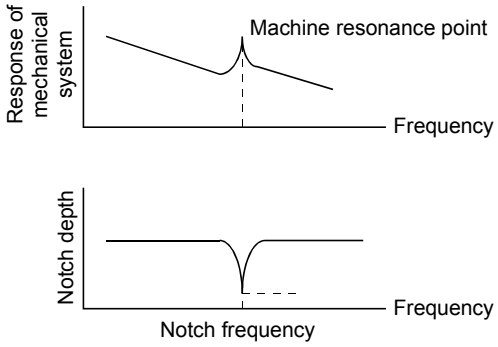
POINT

- The machine resonance suppression filter is a delay factor for the servo system. Therefore, vibration may increase if you set an incorrect resonance frequency or set notch depth too deep or too wide.
- If the frequency of machine resonance is unknown, decrease the notch frequency from higher to lower ones in order. The optimum notch frequency is set at the point where vibration is minimal.
- A deeper notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration.
- The machine characteristic can be grasped beforehand by the machine analyzer on MR Configurator. This allows the required notch frequency and notch characteristics to be determined.

If a mechanical system has a natural resonance point, increasing the servo system response level may cause the mechanical system to produce resonance (vibration or unusual noise) at that resonance frequency. Using the machine resonance suppression filter can suppress the resonance of the mechanical system.

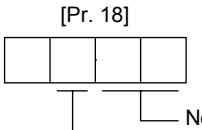
(1) Function

The machine resonance suppression filter is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system. You can set the gain decreasing frequency (notch frequency) and gain decreasing depth.



(2) Parameter

Set the notch frequency and notch depth of [Pr. 18 Machine resonance suppression filter 1 (notch filter)].



Notch frequency selection

Setting value	Frequency	Setting value	Frequency	Setting value	Frequency	Setting value	Frequency
00	Disabled	08	562.5	10	281.3	18	187.5
01	4500	09	500	11	264.7	19	180
02	2250	0A	450	12	250	1A	173.1
03	1500	0B	409.1	13	236.8	1B	166.7
04	1125	0C	375	14	225	1C	160.1
05	900	0D	346.2	15	214.3	1D	155.2
06	750	0E	321.4	16	204.5	1E	150
07	642.9	0F	300	17	195.7	1F	145.2

Notch depth selection

Setting value	Depth (Gain)
0	Deep (-40 dB)
1	↑ (-14 dB)
2	↓ (-8 dB)
3	Shallow (-4 dB)

7.1.2 Low-pass filter

> POINT
>
> ●In a mechanical system with extremely high rigidity where resonance is difficult to occur, setting the low-pass filter to "Disabled" may increase the servo system response to shorten the settling time.

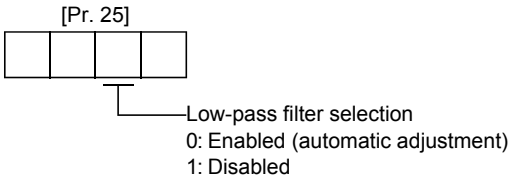
(1) Function

When a ball screw or the like is used, resonance of high frequency may occur as the response level of the servo system is increased. To prevent this, the low-pass filter is enabled for a torque command as the initial value. The filter frequency of the low-pass filter is automatically adjusted to the value in the following equation.

$$\text{Filter frequency (Hz)} = \frac{\text{Speed loop gain 2 setting value} \times 10}{2\pi \times (1 + \text{Load to motor inertia ratio setting value})}$$

(2) Parameter

Set "Low-pass filter selection" in [Pr. 25].



7.2 Gain switching function

You can switch gains with the function. You can switch gains during rotation and during stop, and can use a control command from a controller to switch gains during operation.

7.2.1 Applications

The following shows when you use the function.

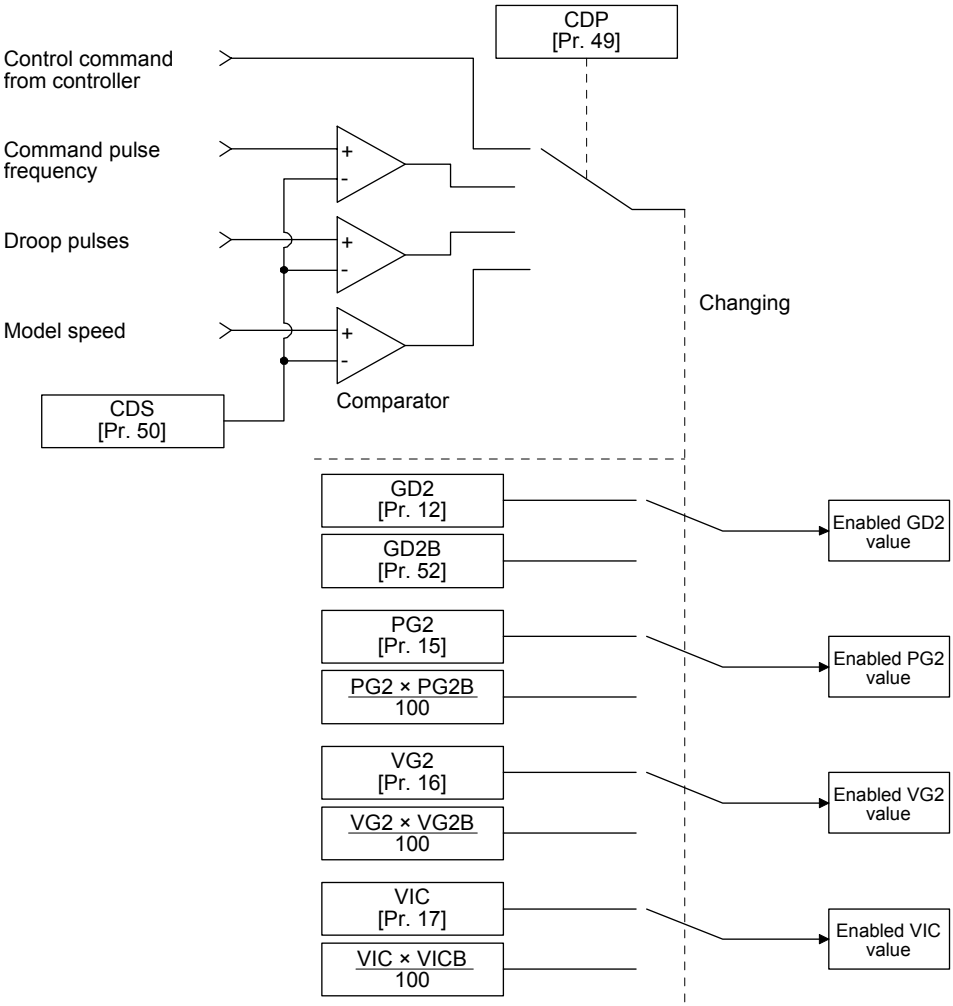
(1) You want to increase the gains during servo-lock but decrease the gains to reduce noise during rotation.

(2) You want to increase the gains during settling to shorten the stop settling time.

(3) You want to change the gains using a control command from a controller to ensure stability of the servo system since the load to motor inertia ratio varies greatly during a stop (e.g. a large load is mounted on a carrier).

7.2.2 Function block diagram

The control gains and load to motor inertia ratio settings are changed according to the conditions selected by [Pr. 49 Gain switching function] and [Pr. 50 Gain switching condition].



7.2.3 Parameter

When using the gain switching function, always select "Manual mode 2 (_ _ _ 2)" of "Gain adjustment mode selection" in [Pr. 8 Auto tuning]. The gain switching function cannot be used in the auto tuning mode.

Parameter	Symbol	Name	Unit	Description
13	PG1	Position loop gain 1	[rad/s]	Position and speed gains of a model used to set the response level to a command. Always enabled.
14	VG1	Speed loop gain 1	[rad/s]	Control parameters before changing
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)	[Multiplier]	
15	PG2	Position loop gain 2	[rad/s]	
16	VG2	Speed loop gain 2	[rad/s]	
17	VIC	Speed integral compensation	[ms]	
52	GD2B	Ratio of load inertia to servo motor inertia 2	[Multiplier]	Set the ratio of load inertia to servo motor inertia after switching.
53	PG2B	Position loop gain 2 change ratio	[%]	Set the ratio (%) of the position loop gain 2 after switching against the position loop gain 2.
54	VG2B	Speed loop gain 2 change ratio	[%]	Set the ratio (%) of the speed loop gain 2 after switching against the speed loop gain 2.
55	VICB	Speed integral compensation change ratio	[%]	Set the ratio (%) of the speed integral compensation time constant after switching against the speed integral compensation.
49	CDP	Gain switching selection		Select the changing condition.
50	CDS	Gain switching condition	[kpulse/s] /[pulse] /[r/min]	Set the changing condition values.
51	CDT	Gain switching time constant	[ms]	Set the filter time constant for a gain change at changing.

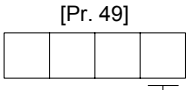
(1) [Pr. 12] to [Pr. 17]
These parameters are the same as in ordinary manual adjustment. Gain switching allows the values of load to motor inertia ratio, position loop gain 2, speed loop gain 2 and speed integral compensation to be changed.

(2) [Pr. 52 Ratio of load inertia to servo motor inertia 2]
Set the ratio of load inertia to servo motor inertia after switching. If the load to motor inertia ratio does not change, set it to the same value as [Pr. 12 Ratio of load inertia to servo motor inertia (load inertia ratio)].

(3) [Pr. 53 Position loop gain 2 change ratio]/[Pr.54 Speed loop gain 2 change ratio]/[Pr. 55 Speed integral compensation change ratio]
Set the values of the position loop gain 2, speed loop gain 2 and speed integral compensation after gain switching in the ratio ([%)]. When the setting is 100%, the gain does not change.
For example, if position loop gain 2 = 100, speed loop gain 2 = 2000, speed integral compensation = 20, and position loop gain 2 change ratio = 180%, speed loop gain 2 change ratio = 150%, and speed integral compensation change ratio = 80%, the values after switching are as follows.
Position loop gain 2
= Position loop gain 2 × Position loop gain 2 change ratio/100 = 180 [rad/s]
Speed loop gain 2
= Position loop gain 2 × Position loop gain 2 change ratio/100 = 3000 [rad/s]
Speed integral compensation = Speed integral compensation × Speed integral compensation change ratio/100 = 16 [ms]

(4) [Pr. 49 Gain switching selection]

Set the gain switching condition. Select the switching condition in the first digit.



Gain switching selection
The gain is changed depending on the setting value of [Pr. 52] to [Pr. 55] with the following conditions.
0: Disabled
1: Control command from controller
2: Command frequency is the [Pr. 50] setting value or more.
3: Droop pulse is the [Pr. 50] setting value or more.
4: Servo motor speed is the [Pr. 50] setting value or more.

(5) [Pr. 50 Gain switching condition]

Set a level to switch gains after you select "Command frequency", "Droop pulses", or "Servo motor speed" in [Pr. 49 Gain switching selection].

The setting unit is as follows.

Gain switching condition	Unit
Command frequency	[kpulse/s]
Droop pulses	[pulse]
Servo motor speed	[r/min]

(6) [Pr. 51 Gain switching time constant]

You can set the primary delay filter to each gain at gain switching. This parameter is used to suppress shock given to the machine if the gain difference is large at gain switching, for example.

7.2.4 Gain switching procedure

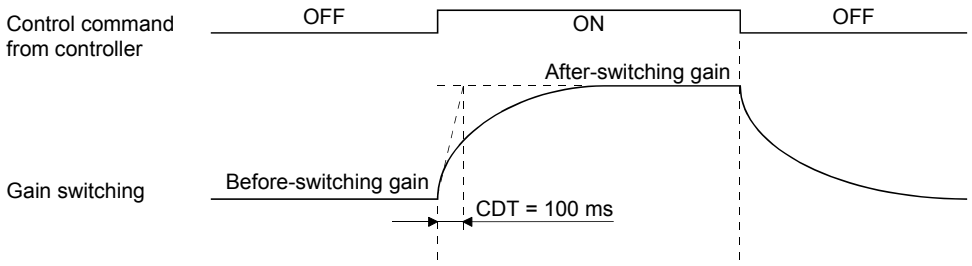
This operation will be described by way of setting examples.

(1) When you choose switching by control command from the controller

(a) Setting

Parameter No.	Symbol	Name	Setting value	Unit
13	PG1	Position loop gain 1	100	[rad/s]
14	VG1	Speed loop gain 1	1000	[rad/s]
12	GD2	Ratio of load inertia to servo motor inertia (load inertia ratio)	40	Multiplier
15	PG2	Position loop gain 2	120	[rad/s]
16	VG2	Speed loop gain 2	3000	[rad/s]
17	VIC	Speed integral compensation	20	[ms]
52	GD2B	Ratio of load inertia to servo motor inertia 2	100	Multiplier
53	PG2B	Position loop gain 2 change ratio	70	[%]
54	VG2B	Speed loop gain 2 change ratio	133	[%]
55	VICB	Speed integral compensation change ratio	250	[%]
49	CDP	Gain switching selection	0001 Control command from controller	
51	CDT	Gain switching time constant	100	[ms]

(b) Switching timing chart



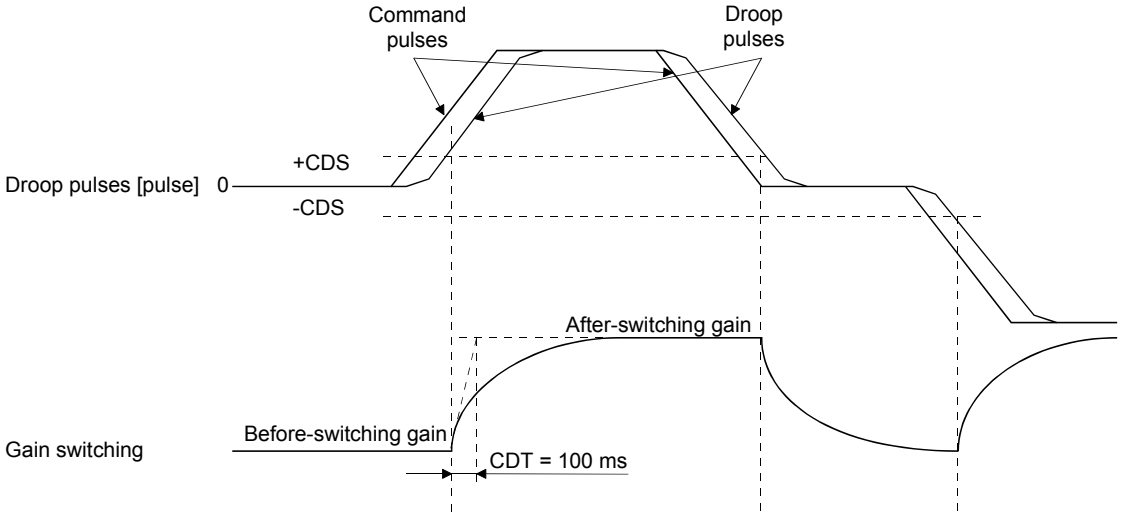
Position loop gain 1	100				
Speed loop gain 1	1000				
Ratio of load inertia to servo motor inertia	4.0	→	10.0	→	4.0
Position loop gain 2	120	→	84	→	120
Speed loop gain 2	3000	→	4000	→	3000
Speed integral compensation	20	→	50	→	20

(2) When you choose switching by droop pulses

(a) Setting

Parameter No.	Symbol	Name	Setting value	Unit
13	PG1	Position loop gain 1	100	[rad/s]
14	VG1	Speed loop gain 1	1000	[rad/s]
12	GD2	Ratio of load inertia to servo motor inertia	40	Multiplier
15	PG2	Position loop gain 2	120	[rad/s]
16	VG2	Speed loop gain 2	3000	[rad/s]
17	VIC	Speed integral compensation	20	[ms]
52	GD2B	Ratio of load inertia to servo motor inertia 2	100	Multiplier
53	PG2B	Position loop gain 2 change ratio	70	[%]
54	VG2B	Speed loop gain 2 change ratio	133	[%]
55	VICB	Speed integral compensation change ratio	250	[%]
49	CDP	Gain switching selection	0003 (switching by droop pulses)	
50	CDS	Gain switching condition	50	[pulse]
51	CDT	Gain switching time constant	100	[ms]

(b) Switching timing chart



Position loop gain 1	100						
Speed loop gain 1	1000						
Ratio of load inertia to servo motor inertia	4.0	→	10.0	→	4.0	→	10.0
Position loop gain 2	120	→	84	→	120	→	84
Speed loop gain 2	3000	→	4000	→	3000	→	4000
Speed integral compensation	20	→	50	→	20	→	50

8. TROUBLESHOOTING

8.1 Alarm and warning list

When an error occurs during operation, the corresponding alarm and warning are displayed. If any alarm or warning has occurred, refer to section 8.2 or 8.3 and take the appropriate action.
After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column in the following table.

	No.	Name	Stop method (Note 6)	Alarm reset		
				Power off to on	Error reset	CPU reset
Alarm	10	Undervoltage	EDB	○	○	○
	12. _ (Note 5)	Memory error 1	DB	○		
	13	Clock error	DB	○		
	15	Memory error 2	DB	○		
	16	Encoder error 1	DB	○		
	17	Board error	DB	○		
	19. _	Memory error 3	DB	○		
	1A	Motor combination error	DB	○		
	20	Encoder error 2	EDB	○		
	24	Main circuit error	DB	○	○	○
	25	Absolute position erased	DB	○ (Note 2)		
	30	Regenerative error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	31	Overspeed	EDB	○	○	○
	32	Overcurrent	DB	○	○ (Note 4)	○ (Note 4)
	33	Overvoltage	EDB	○	○	○
	34	CRC error	EDB	○	○	○
	35	Command frequency error	EDB	○	○	○
	36	Transfer error	EDB	○	○	○
	37	Parameter error	DB	○		○ (Note 4)
	3E. 2	Mode selection error	DB	○		○ (Note 3)
	45	Main circuit device overheat	EDB	○ (Note 1)	○ (Note 1, 4)	○ (Note 1, 4)
	46	Servo motor overheat	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	50	Overload 1	EDB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	51	Overload 2	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	52	Error excessive	EDB	○	○	○
	8E	Serial communication error	EDB	○	○	○
	888	Watchdog	DB	○		
Warnings	92	Battery cable disconnection warning		Warnings are automatically canceled after the cause of occurrence is removed.		
	96	Home position setting warning				
	9F	Battery warning				
	E0	Excessive regeneration warning				
	E1	Overload warning				
	E3	Absolute position counter warning				
	E4	Parameter warning				
	E6	Servo forced stop warning	EDB (Note 7)			
	E7	Controller forced stop warning	EDB			
	E9	Main circuit off warning	DB			
	EE	SSCNET error warning				

Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.
2. For confirming the connection to the servo system controller, the alarm may not be reset unless turning the power on twice or more times.
3. When the mode is correctly set, it will be reset.
4. The alarm factor may not be removed depending on the cause of occurrence.
5. Digits after the decimal point may not be displayed.
6. The following shows two stop methods of DB and EDB.
DB: Stop with dynamic brake
EDB: Stop with electronic dynamic brake (enabled only with the specified servo motors)
Refer to the following table for the specified servo motors. The stop method for other than the specified servo motors will be DB.

Series	Servo motor
HG-KR	HG-KR053/HG-KR13/HG-KR23/HG-KR43
HG-MR	HG-MR053/HG-MR13/HG-MR23/HG-MR43
HG-SR	HG-SR51/HG-SR52

7. When STO1 or STO2 is turned off (when the short-circuit connector is disconnected), the stop method will be DB.

8.2 Remedies for alarms

⚠CAUTION	●When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation. Otherwise, it may cause injury. ●If [AL. 25 Absolute position erased] occurs, always make home position setting again. Otherwise, it may cause an unexpected operation. ●As soon as an alarm occurs, set the servo amplifier to the servo-off status and interrupt the main circuit power.

POINT

●When any of the following alarms has occurred, do not deactivate the alarm to restart. Doing so will cause a malfunction of the servo amplifier and servo motor. Remove its cause and allow about 30 minutes for cooling before resuming the operation. To protect the main circuit elements, any of these servo alarms cannot be deactivated from the servo system controller until the specified time elapses after its occurrence. Judging the load changing condition until the alarm occurs, the servo amplifier calculates this specified time automatically.
 ・[AL. 30 Regenerative error] ・[AL. 50 Overload 1]
 ・[AL. 51 Overload 2]
●To deactivate the alarm, cycle the power, command the error reset, or CPU reset from the servo system controller. Refer to section 8.1.
●[AL. 37 Parameter error] is not recorded in the alarm history.

When an alarm occurs, the dynamic brake is operated to stop the servo motor. At this time, the display indicates the alarm No.
Remove the cause of the alarm in accordance with this section. Use MR Configurator to refer to the cause of alarm occurrence. However, it is not applicable for [AL. 12. _], [AL. 19. _], [AL. 3E.2] and [AL. 888].

Display	Name	Description	Cause	Action
10	Undervoltage	The power supply voltage dropped. 200 V class: 160 V AC or less 400 V class: 280 V AC or less 100 V class: 80 V AC or less	1. Power supply voltage is low.	Review the power.
			2. There was an instantaneous control circuit power failure of 60 ms or more.	
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
			4. The bus voltage dropped to the following value or less. 200 V class: 200 V DC or less 400 V class: 380 V DC or less 100 V class: 158 V DC or less	
			5. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 10] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.

Display	Name	Description	Cause	Action
12. _	Memory error 1	RAM memory error	1. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 12] or [AL. 13] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
13	Clock error	Printed board error		
		A clock error transmitted from the controller	2. The controller is malfunctioning. Check method Check if the alarm occurs when you connect the amplifier to the controller.	Replace the controller.
		Next servo amplifier axis error	3. The servo amplifier of the next axis is malfunctioning.	Replace the servo amplifier of the next axis.
		Software process incomplete within the specified time	4. The parameter setting is incorrect.	Set it correctly.
			5. A synchronous signal error transmitted from the controller occurred. Check method Replace the controller, and then check the repeatability.	Replace the controller.
15	Memory error 2	EEP-ROM error	1. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 15] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
			2. The number of write times exceeded 100,000.	
			3. The EEP-ROM is malfunctioning during normal operation. Check method Check if the error occurs when you change parameters during normal operation.	
			4. A write error occurred while tuning results was processed. Check method Check if the alarm occurs after an hour from power on.	
			5. The system parameter error occurred. Check method Check if an alarm occurs when you initialize the parameters with the built-in application software "MR-J4(W)-B mode selection" of MR Configurator2.	

Display	Name	Description	Cause	Action
16	Encoder error 1	An error occurred in the communication between the encoder and servo amplifier.	1. The Encoder connector (CN2) is disconnected.	Connect it correctly.
			2. The encoder is malfunctioning.	Replace the servo motor.
			3. There is a loose connection of the encoder cable. (It is disconnected or shorted.)	Repair or replace the encoder cable.
			4. The servo amplifier is malfunctioning.	Replace the servo amplifier.
			5. The voltage of the control circuit power supply has been unstable.	Review the power and related parts.
		Incompatible encoder	6. A servo motor, which is not compatible with the servo amplifier, was connected.	Replace it with the servo motor which is compatible with the servo amplifier.
17	Board error	A part such as CPU is malfunctioning.	1. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 17] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
		The output terminals (U, V, W) of the servo amplifier and the input terminals (U, V, W) of the servo motor are not connected.	2. The wiring of U, V, W is disconnected or not connected.	Connect the output terminals (U, V, W) of the servo amplifier and the input terminals (U, V, W) of the servo motor correctly.
		Servo amplifier recognition signal error	3. The servo amplifier recognition signal was not read properly. Check method Check if [AL. 17] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
		Inrush current suppression circuit error	4. The inrush current suppressor circuit is malfunctioning.	Replace the servo amplifier.
		Mode selection error	5. There is a mismatch between the operation mode setting and actual operation mode.	Initialize it with the built-in application software "MR-J4(W)-B mode selection" of MR Configurator2.
		MR-J4-T20 error	6. MR-J4-T20 came off.	Check the connection of MR-J4-T20.
19. _	Memory error 3	ROM memory error	1. A part in the servo amplifier is malfunctioning. Check method Check if [AL. 19] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.
1A	Servo motor combination error	The combination of servo amplifier and servo motor is incorrect.	1. The servo amplifier and the servo motor was connected incorrectly.	Use them in the correct combination.
		Encoder error	2. The encoder is malfunctioning.	Replace the servo motor.
20	Encoder error 2	An error occurred in the communication between the encoder and servo amplifier.	1. The Encoder connector (CN2) is disconnected.	Connect it correctly.
			2. The encoder is malfunctioning.	Replace the servo motor.
			3. The encoder cable is malfunctioning. (It is disconnected or shorted.)	Repair or replace the cable.
			4. The servo amplifier is malfunctioning.	Replace the servo amplifier.
		The function detects an acceleration error in the encoder.	5. An excessive acceleration occurred due to oscillation, etc.	1. Decrease the speed control gain 2. 2. Decrease the auto tuning response level.

Display	Name	Description	Cause	Action
24	Main circuit error	Ground fault occurred at the servo motor power output (U, V, and W) of the servo amplifier.	1. The power wire is contacting with the servo motor power output (U, V, and W) of the servo amplifier.	Correct the wiring.
			2. The insulator of servo motor power wire deteriorated, resulting in ground fault.	Replace the cable.
			3. The main circuit of servo amplifier failed. Check method Check if [AL. 24] occurs if power is switched on after disconnection of U, V, and W.	Replace the servo amplifier.
25	Absolute position erased	Power was switched on for the first time in the absolute position detection system.	1. Power was switched on for the first time in the absolute position detection system.	Check that the battery is mounted correctly, and make home position return.
		The absolute position data is faulty.	2. When an MR-BAT6V1SET battery was used, CN4 of the servo amplifier was disconnected during control circuit power supply off.	Check that the battery is mounted correctly, and make home position return.
			3. When an MR-BAT6V1BJ battery for junction battery cable was used, both CN4 of the servo amplifier and MR-BAT6V1BJ battery for junction battery cable were disconnected from the MR-BT6VCBL03M junction battery cable.	
			4. When an MR-BAT6V1SET battery was used, the power was turned off with the battery disconnected from CN4.	
			5. When an MR-BAT6V1BJ battery for junction battery cable was used, the power was turned off with the battery disconnected from CN4 and MR-BT6VCBL03M junction battery cable.	
			6. The encoder cable was disconnected with the MR-BAT6V1BJ battery disconnected from MR-BT6VCBL03M junction battery cable.	Check that the MR-BAT6V1BJ battery is connected to CN4 and MR-BT6VCBL03M junction battery cable, and execute a home position return.
			7. The MR-BT6VCBL03M junction battery cable is not connected to the encoder cable.	Connect the MR-BT6VCBL03M junction battery cable to the encoder cable.
			8. The battery voltage is low. The battery is consumed.	Replace the battery.
			9. The voltage has dropped greatly in the encoder cable wired to the battery.	Use a recommended wire.
			10. A battery cable is malfunctioning.	Replace the battery cable.
			11. There is a loose connection of the encoder cable on the servo motor side.	Repair or replace the encoder cable.
		Encoder error	12. An encoder is malfunctioning.	Replace the servo motor.
		Servo amplifier error	13. The servo amplifier is malfunctioning.	Replace the servo amplifier.

Display	Name	Description	Cause	Action
30	Regenerative error	Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded.	There is a mismatch between the built-in regenerative resistor (regenerative option) and [Pr. 2] setting.	Set it correctly.
			2. The built-in regenerative resistor or regenerative option is not connected.	Connect it correctly.
			3. Very frequent operation or continuous regenerative operation caused the permissible regenerative power of the regenerative option to be exceeded. Check method Check the regenerative load ratio using MR Configurator.	1. Reduce the frequency of positioning. 2. Replace the regenerative option for the one with larger capacity. 3. Reduce the load.
			4. The power supply voltage is too high. 200 V class: 264 V AC or more 400 V class: 523 V AC or more 100 V class: 132 V AC or more	Review the power.
			5. The built-in regenerative resistor or regenerative option is malfunctioning.	Replace the servo amplifier or regenerative option.
		Regenerative transistor failure	6. The regenerative transistor is malfunctioning. Check method 1. Check if the regenerative option is overheating. 2. Check if the alarm occurs even after removal of the built-in regenerative resistor or regenerative option.	Replace the servo amplifier.
31	Overspeed	The servo motor seed has exceeded the permissible instantaneous speed.	1. The short acceleration/deceleration time constant increased the overshoot.	Increase the acceleration/deceleration time constant.
			2. The servo system is unstable, causing an overshoot.	1. Reset the servo gain to a proper value. 2. If the servo gain cannot be set to a proper value. 1) Reduce the load to motor inertia ratio. 2) Review the acceleration/deceleration time constant.
			3. The encoder is malfunctioning.	Replace the servo motor.
			4. The command from the controller is excessive.	Check the operation pattern.

Display	Name	Description	Cause	Action
32	Overcurrent	A current higher than the permissible current was applied to the servo amplifier.	1. Short occurred in the servo amplifier output phases U, V and W.	Correct the wiring.
			2. A transistor in the servo amplifier is malfunctioning. Check method Check if [AL. 32] occurs if power is switched on after disconnection of U, V, and W.	Replace the servo amplifier.
			3. Ground fault occurred in servo amplifier output phases U, V and W.	Correct the wiring.
			4. The servo motor is malfunctioning.	Replace the servo motor.
			5. The dynamic brake is malfunctioning. Check method Check if this occurs when you turn on the servo-on command.	Replace the servo amplifier.
			6. External noises caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.
			7. The servo gain is high.	Reduce the speed loop gain.
33	Overvoltage	The value of the bus voltage exceeded the prescribed value. 200 V class: 400 V DC or more 400 V class: 800 V DC or more 100 V class: 400 V DC or more	1. A regenerative option is not used.	Use a regenerative option.
			2. Though the regenerative option is used, the [Pr. 2] setting is "0 0 _ _ (the regenerative option is not used.)".	Set it correctly.
			3. The lead wire of built-in regenerative resistor or regenerative option is broken or disconnected.	1. Replace the lead wire. 2. Connect it correctly.
			4. The regenerative transistor is malfunctioning.	Replace the servo amplifier.
			5. Wire breakage of the built-in regenerative resistor or regenerative option	When using a built-in regenerative resistor, replace the servo amplifier. When using a regenerative option, replace the regenerative option.
			6. The capacity of built-in regenerative resistor or regenerative option is insufficient.	Add another regenerative option or increase the capacity.
			7. The power supply voltage is high.	Review the power.
			8. Ground fault occurred in servo amplifier output phases (U, V and W).	Correct the wiring.
			9. The jumper across BUE-SD of the FR-BU2 brake unit is removed.	Fit the jumper across BUE-SD.
			10. The impedance at main circuit power supply cable (L1, L2, and L3) is high, and the leak current from servo motor power wire (U, V, and W) is large.	Use a regenerative option. (A regenerative resistor not incorporated)
34	CRC error	Communication error with the SSCNET cable	1. The SSCNET cable was disconnected.	Connect it correctly.
			2. The SSCNET cable is malfunctioning.	Replace the cable.
			3. Noises entered into the SSCNET cable.	Take noise suppression measures.
			4. The terminal connector was disconnected.	Mount the termination connector.
			5. The same No. exists in the servo amplifier side axis setting.	Set it correctly.

Display	Name	Description	Cause	Action
35	Command frequency error	The input pulse frequency of command pulse is too high.	1. A command given was greater than the maximum speed of the servo motor.	Check the operation program.
			2. Noises entered into the SSCNET cable.	Take noise suppression measures.
			3. The servo system controller is malfunctioning.	Replace the servo system controller.
36	Transfer error	SSCNET cable or printed board malfunction	1. The SSCNET cable was disconnected.	Connect the SSCNET cable connector.
			2. The SSCNET cable is malfunctioning.	Replace the cable.
			3. The printed board is malfunctioning.	Replace the servo amplifier.
			4. The terminal connector was disconnected.	Mount the termination connector.
37	Parameter error	The parameter setting is incorrect.	1. The parameter setting has changed due to a servo amplifier malfunction.	Replace the servo amplifier.
			2. A parameter was set out of setting range.	Correct the parameter value to within the setting range.
			3. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, etc.	Replace the servo amplifier.
			4. A parameter setting contradicts another.	Correct the setting value.
3E.2	Mode selection error	There is a mismatch between the operation mode setting and actual operation mode.	The power supply was turned on with MR-J4-T20 disconnected.	1. Connect MR-J4-T20 and restart the servo amplifier. 2. Select J2S compatibility mode with the built-in application software "MR-J4(W)-B mode selection" of MR Configurator2.
45	Main circuit device overheat	The main circuit was overheated.	1. The servo amplifier is malfunctioning.	Replace the servo amplifier.
			2. The ambient temperature is over 55 ˚C.	Lower the ambient temperature.
			3. Turning on and off were repeated under the overload status.	Review the operation pattern.
			4. The cooling fan of the servo amplifier stopped.	1. Replace the servo amplifier or cooling fan. 2. Lower the ambient temperature.
			5. The cooling fan speed is lower than the prescribed value.	Replace the servo amplifier.
46	Servo motor overheat	A servo motor temperature rise actuated the thermal sensor.	1. The ambient temperature of servo motor is over 40 ˚C.	Review the environment so that the ambient temperature is 0 ˚C to 40 ˚C.
			2. The servo motor is overloaded.	1. Reduce the load. 2. Check the operation pattern. 3. Switch to a larger capacity servo motor.
			3. The thermal sensor in the encoder is malfunctioning.	Replace the servo motor.
		Thermistor wire connection malfunction	4. A thermistor wire is not connected.	Connect the thermistor wire.
			5. The encoder cable MR-ENECBL_M-H for HF-JP series servo motors is used for the HG-JR22K1M/HG-JR22K1M4 servo motor.	Replace the encoder cable with MR-ENECBL_M-HMTH.
			6. The thermistor wire was disconnected.	Repair the lead wire.
		Thermal error due to overload	7. The servo amplifier was used in excess of its continuous output current.	1. Reduce the load. 2. Check the operation pattern. 3. Switch to a larger capacity servo motor.

Display	Name	Description	Cause	Action
50	Overload 1	The load exceeded the overload protection characteristic of servo amplifier.	1. The servo amplifier is used in excess of its continuous output current.	1. Reduce the load. 2. Check the operation pattern. 3. Switch to a larger capacity servo motor.
			2. The servo system is unstable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change the auto tuning response setting. 3. Set the auto tuning to off and manually adjust the gain.
			3. A moving part collided against the machine.	1. Check the operation pattern. 2. Install limit switches.
			4. The servo motor is connected incorrectly. The output terminals (U, V, W) of the servo amplifier do not match the input terminals (U, V, W) of the servo motor.	Connect it correctly.
			5. The power cable was disconnected.	Repair the power cable.
			6. The electromagnetic brake is operating. Check method Check if the electromagnetic brake does not work during operation.	Review the wiring.
			7. After the overload alarm occurrence, the operation was resumed without cooling. Check method Wait for 30 minutes or more after an alarm occurs and check if the alarm is canceled.	Leave a sufficient time and reset the alarm.
			8. The servo amplifier is malfunctioning.	Replace the servo amplifier.
			9. The encoder is malfunctioning. Check method When the servo motor shaft is rotated with the servo-off, check if the cumulative feedback pulses do not vary in proportion to the rotation angle of the shaft but the indication skips or returns midway.	Replace the servo motor.

Display	Name	Description	Cause	Action
51	Overload 2	The maximum output current flowed continuously for several seconds due to a machine collision or the like.	1. A moving part collided against the machine.	1. Check the operation pattern. 2. Install limit switches.
			2. The servo motor is connected incorrectly. The output terminals (U, V, W) of the servo amplifier do not match the input terminals (U, V, W) of the servo motor.	Connect it correctly.
			3. The power cable was disconnected.	Repair the power cable.
			4. The connection of the encoder cable is incorrect.	Connect it correctly.
			5. The servo system is unstable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change the auto tuning response setting. 3. Set the auto tuning to off and manually adjust the gain.
			6. The torque is saturated.	Check the operation pattern.
			7. The servo amplifier is malfunctioning.	Replace the servo amplifier.
			8. The encoder is malfunctioning. Check method When the servo motor shaft is rotated with the servo-off, check if the cumulative feedback pulses do not vary in proportion to the rotation angle of the shaft but the indication skips or returns midway.	Replace the servo motor.

Display	Name	Description	Cause	Action
52	Error excessive	The deviation between the model position and the actual servo motor position exceeds the [Pr. 31] setting value (initial value: 2 revolutions).	1. The acceleration/deceleration time constant is too short.	Increase the acceleration/deceleration time constant.
			2. The torque limit value is small.	Increase the torque limit value.
			3. The motor cannot be started due to torque shortage caused by a power supply voltage drop.	1. Check the power supply capacity. 2. Switch to a larger capacity servo motor.
			4. The [Pr. 13 Position loop gain 1] value is small.	Increase the setting value and adjust to ensure proper movement.
			5. The servo motor shaft was rotated by external force.	1. When the torque is limited, increase the limit value. 2. Reduce the load. 3. Switch to a larger capacity servo motor.
			6. A moving part collided against the machine.	1. Check the operation pattern. 2. Install limit switches.
			7. The encoder is malfunctioning.	Replace the servo motor.
			8. The connection of the servo motor is incorrect. The output terminals (U, V, W) of the servo amplifier do not match the input terminals (U, V, W) of the servo motor.	Connect it correctly.
			9. The power cable was disconnected.	Repair the power cable.
			10. The connection of the encoder cable is incorrect.	Connect it correctly.
8E	Serial communication error	A serial communication error occurred between the servo amplifier and communication device (e.g. personal computer).	1. A communication cable is malfunctioning. (It is disconnected or shorted.)	Repair or replace the cable.
			2. Communication device (e.g. personal computer) is malfunctioning.	Replace the communication device (e.g. personal computer).
			3. The transmitted character was out of specifications.	Correct the transmission command.
			4. The communication protocol is incorrect.	Modify the transmission data according to the communication protocol.
			5. The transmitted command was out of specifications.	Correct the transmission command.
			6. The transmitted data number was out of specifications.	Correct the transmission command.
			7. The servo amplifier is malfunctioning.	Replace the servo amplifier.
888	Watchdog	A part such as CPU is malfunctioning.	A part in the servo amplifier is malfunctioning. Check method Check if [AL. 888] occurs if power is switched on after disconnection of all cables except the control circuit power cable.	Replace the servo amplifier.

8.3 Remedies for warnings

⚠CAUTION ●If [AL. E3 Absolute position counter warning] occurs, always make home position setting again. Otherwise, it may cause an unexpected operation.

POINT

●When any of the following alarms has occurred, do not cycle the power of the servo amplifier repeatedly to restart. Doing so will cause a malfunction of the servo amplifier and servo motor. If the power of the servo amplifier is switched off/on during the alarms, allow more than 30 minutes for cooling before resuming operation.
- [AL. E0 Excessive regenerative warning]
- [AL. E1 Overload warning]

●The warnings are not recorded in the alarm history.

If [AL. E6], [AL. E7], [AL. E9] or [AL. EE] occurs, the amplifier will be in the servo-off status. If any other warning occurs, the operation can be continued but an alarm may take place or proper operation may not be performed.
Remove the cause of warning according to this section. Use MR Configurator to refer to the cause of warning occurrence.

Display	Name	Description	Cause	Action
92	Battery cable disconnection warning	Battery voltage for absolute position detection system decreased.	1. When an MR-BAT6V1SET battery was used, the battery was disconnected from CN4.	Connect it correctly.
			2. When an MR-BAT6V1BJ battery for junction battery cable was used, the battery was not connected to both CN4 and MR-BT6VCBL03M junction battery cable.	
			3. A battery cable was disconnected.	Replace or repair the cable.
			4. Battery voltage supplied from the servo amplifier to the encoder fell to less than about 3.1 V. (Detected with the encoder)	Replace the battery.
			5. An encoder cable was disconnected.	Replace or repair the cable.
96	Home position setting warning	Home position setting could not be made properly.	1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence.
			2. Home position return was performed while commanding an operation.	Reduce the creep speed.
			3. The creep speed is high.	
9F	Battery warning	Battery voltage for absolute position detection system decreased.	1. The battery is not connected to CN4.	Connect it correctly.
			2. Battery voltage fell to less than 4.9 V. (Detected with the servo amplifier)	Replace the battery.
E0	Excessive regeneration warning	There is a possibility that the regenerative power may exceed the permissible regenerative power of built-in regenerative resistor or regenerative option.	The regenerative power increased to 85% or more of the permissible regenerative power of built-in regenerative resistor or regenerative option. Check method Check the regenerative load ratio using MR Configurator.	1. Reduce the frequency of positioning. 2. Replace the regenerative option for the one with larger capacity. 3. Reduce the load.

Display	Name	Description	Cause	Action
E1	Overload warning	[AL.50 Overload 1] or [AL.51 Overload 2] may occur.	1. The load increased to 85% or more of the alarm level of [AL.50 Overload alarm 1] or [AL.51 Overload alarm 2]. Check method Check it with the check method for [AL. 50] or [AL. 51].	Refer to [AL. 50] or [AL. 51].
		The servo motor overheat alarm may occur.	2. The load of the motor thermal value increased to 85% or more of the servo motor overheat alarm level. Check method Check it with the check method for [AL. 46].	Refer to [AL. 46].
			3. Ambient temperature of servo motor is over 40 ˚C.	Review environment so that ambient temperature is 0 ˚C to 40 ˚C.
			4. Servo motor is overloaded.	1. Reduce the load. 2. Check operation pattern. 3. Switch to a larger capacity servo motor.
			5. The servo motor thermistor is malfunctioning.	Replace the servo motor.
		The main circuit device overheat alarm may occur.	6. The temperature in the servo amplifier is high. Check method Check it with the check method for [AL. 45].	Refer to [AL. 45].
		Operations over rated output were repeated while the servo motor shaft was not rotated.	7. The load is too large or the capacity is not enough.	1. Reduce the load. 2. Replace the servo amplifier/servo motor with the one of larger capacity.
		The status, in which the output wattage (speed × torque) of the servo motor exceeded the rated output, continued steadily.	8. The status, in which the output wattage (speed × torque) of the servo motor exceeded 150% of the rated output.	1. Reduce the servo motor speed. 2. Reduce the load.
E3	Absolute position counter warning	Absolute position encoder pulses are faulty.	1. The travel distance from the home position exceeded 32768 rotation in the absolute position system.	1. Review the operation range. 2. Execute the home position return again.
			2. Noises entered into the encoder.	Take noise suppression measures.
			3. The encoder is malfunctioning.	Replace the servo motor.
E4	Parameter warning	Parameter outside setting range	A parameter was set to out of range with the servo system controller.	Set it within the range.
E6	Servo forced stop warning	EM1 is off.	1. The forced stop was enabled. (EM1 was turned off.)	Ensure safety and deactivate the forced stop.
		STO1 is off.	2. The short-circuit connector of CN8 is disconnected.	Attach the short-circuit connector came with a servo amplifier.
		STO2 is off.	3. The short-circuit connector of CN8 is disconnected.	Attach the short-circuit connector came with a servo amplifier.
E7	Controller forced stop warning		The forced stop signal was entered into the servo system controller.	Ensure safety and deactivate forced stop.
E9	Main circuit off warning	The servo-on command was inputted with main circuit power supply off.	1. The main circuit power supply is off.	Turn on the main circuit power.
			2. The bus voltage is less than the specified value. 200 V class: 215 V DC 400 V class: 430 V DC 100 V class: 215 V DC	Review the wiring. Check the power supply capacity.
		The bus voltage dropped during low speed operation.	3. The bus voltage dropped during the servo motor driving under 50 r/min.	Review the power supply capacity. Increase the acceleration time constant.
EE	SSCNET error warning	The connected servo system controller is not compatible with the SSCNET.		

8.4 Troubleshooting at power on

When the servo system does not boot and system error occurs at power on of the servo system controller, improper boot of the servo amplifier might be the cause. Check the display of the servo amplifier, and take actions according to this section.

Display	Description	Cause	Checkpoint	Action
AA	Communication with the servo system controller has disconnected.	The power of the servo system controller was turned off.	Check the power of the servo system controller.	Switch on the power of the servo system controller.
		A SSCNET cable was disconnected.	"AA" is displayed in the corresponding axis and following axes.	Replace the SSCNET cable of the corresponding axis.
			Check if the connectors (CN10A, CN10B) are unplugged.	Connect it correctly.
		The terminal connector is disconnected.	Check that the terminal connector (MR-A-TM) is connected with the terminal axis servo amplifier connector (CN10B).	Mount it correctly.
		The power of the servo amplifier was turned off.	"AA" is displayed in the corresponding axis and following axes.	Check the power of the servo amplifier.
				Replace the servo amplifier of the corresponding axis.
Ab	Initialization communication with the servo system controller has not completed.	The setting of the axis No. is incorrect.	Check that the other servo amplifier is not assigned to the same axis No.	Set it correctly.
		Axis No. does not match with the axis No. set to the servo system controller.	Check the setting and axis No. of the servo system controller.	Set it correctly.
		A SSCNET cable was disconnected.	"Ab" is displayed in the corresponding axis and following axes.	Replace the SSCNET cable of the corresponding axis.
			Check for incorrect connection of the SSCNET cable to CN3.	Connect it correctly.
			Check if the connectors (CN10A, CN10B) are unplugged.	Connect it correctly.
		The terminal connector is disconnected.	Check that the terminal connector (MR-A-TM) is connected with the terminal axis servo amplifier connector (CN10B).	Mount it correctly.
		The power of the servo amplifier was turned off.	"Ab" is displayed in an axis and the following axes.	Check the power of the servo amplifier.
		The servo amplifier is malfunctioning.	"Ab" is displayed in an axis and the following axes.	Replace the servo amplifier of the corresponding axis.
b##. (Note)	The system has been in the test operation mode.	Test operation mode has been enabled.	The axis selection rotary switch (SW1) is set to "F".	Set the axis selection rotary switch (SW1) correctly.
off	The operation mode for manufacturer setting is set.	The operation mode for manufacturer setting is enabled.	Check if the control axis setting switches (SW2-1 to SW2-4) are on.	Turn off all the control axis setting switches (SW2).

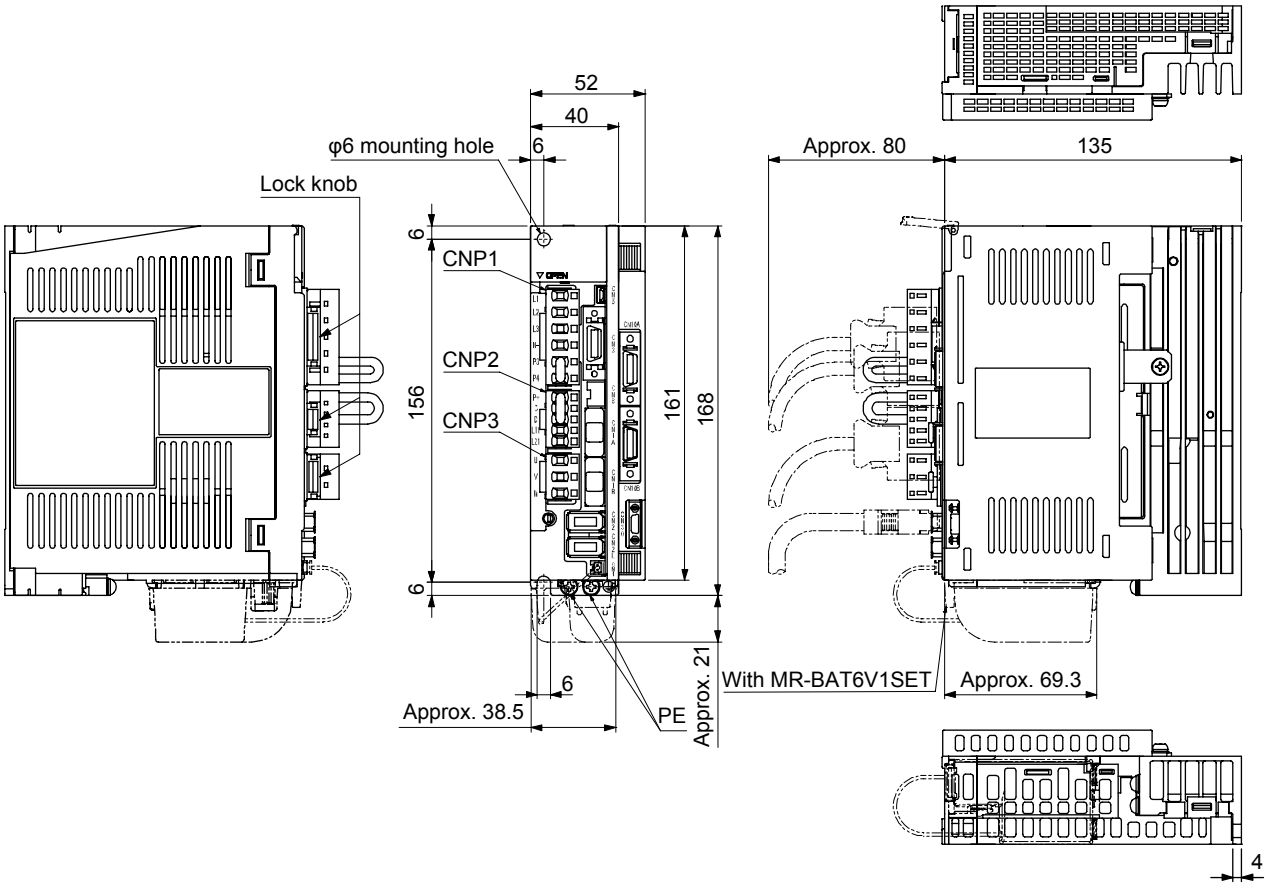
Note. ## indicates an axis No.

9. DIMENSIONS

9.1 Servo amplifier

(1) MR-J4-10B-RJ020/MR-J4-20B-RJ020

[Unit: mm]



Mass: 0.8 [kg] (servo amplifier only)

Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

Terminal

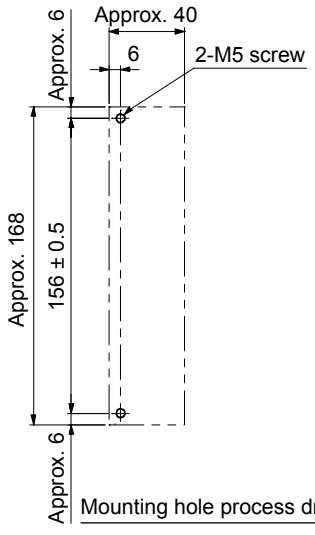
CNP1
L1
L2
L3
N-
P3
P4

CNP2
P+
C
D
L11
L21

CNP3
U
V
W

PE

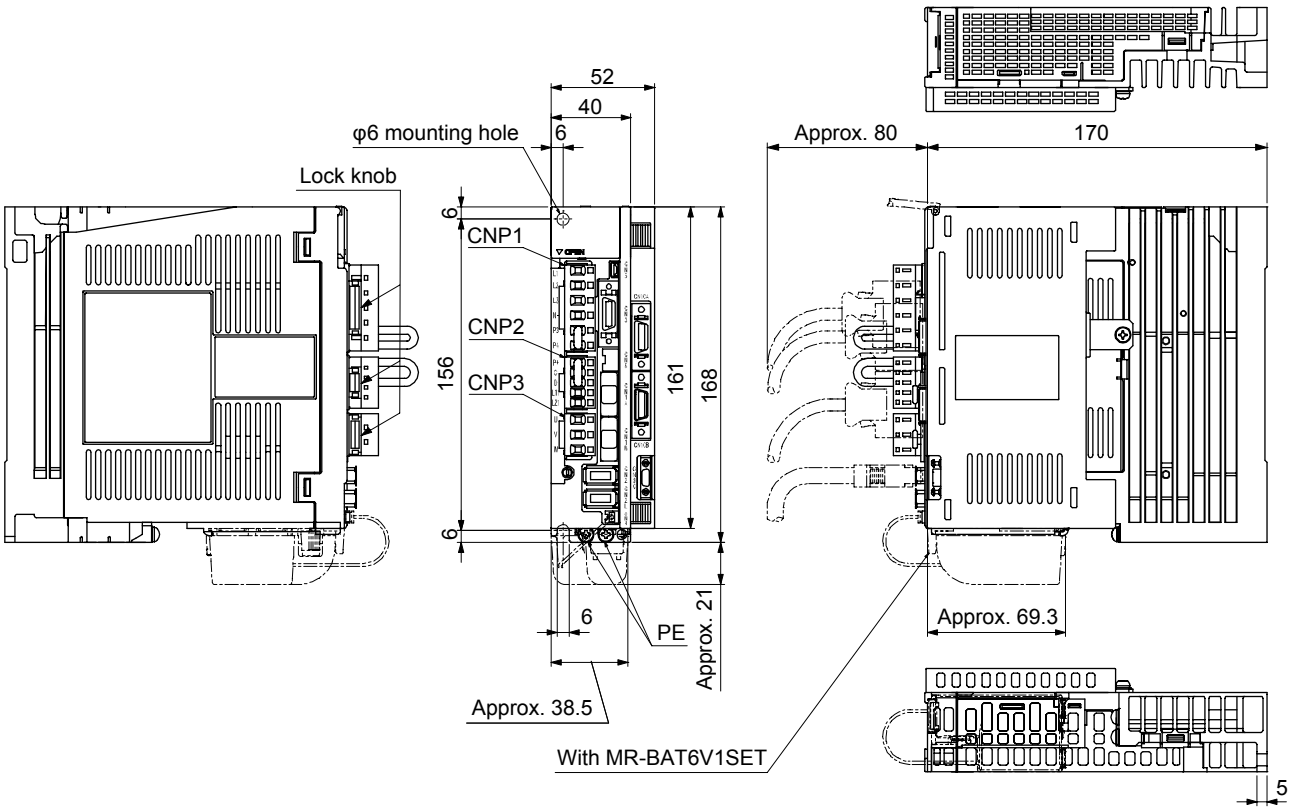
Screw size: M4
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(2) MR-J4-40B-RJ020/MR-J4-60B-RJ020

[Unit: mm]



Mass: 1.0 [kg] (servo amplifier only)

Terminal

CNP1
L1
L2
L3
N-
P3
P4

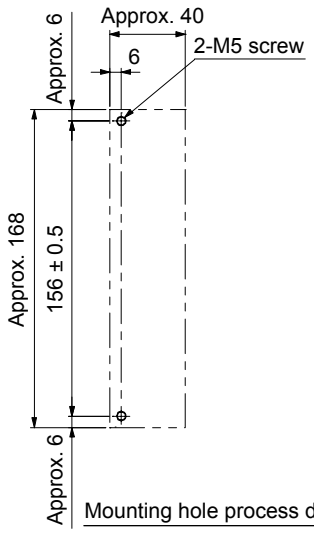
CNP2
P+
C
D
L11
L21

CNP3
U
V
W

PE

Screw size: M4
Tightening torque: 1.2 [N•m]

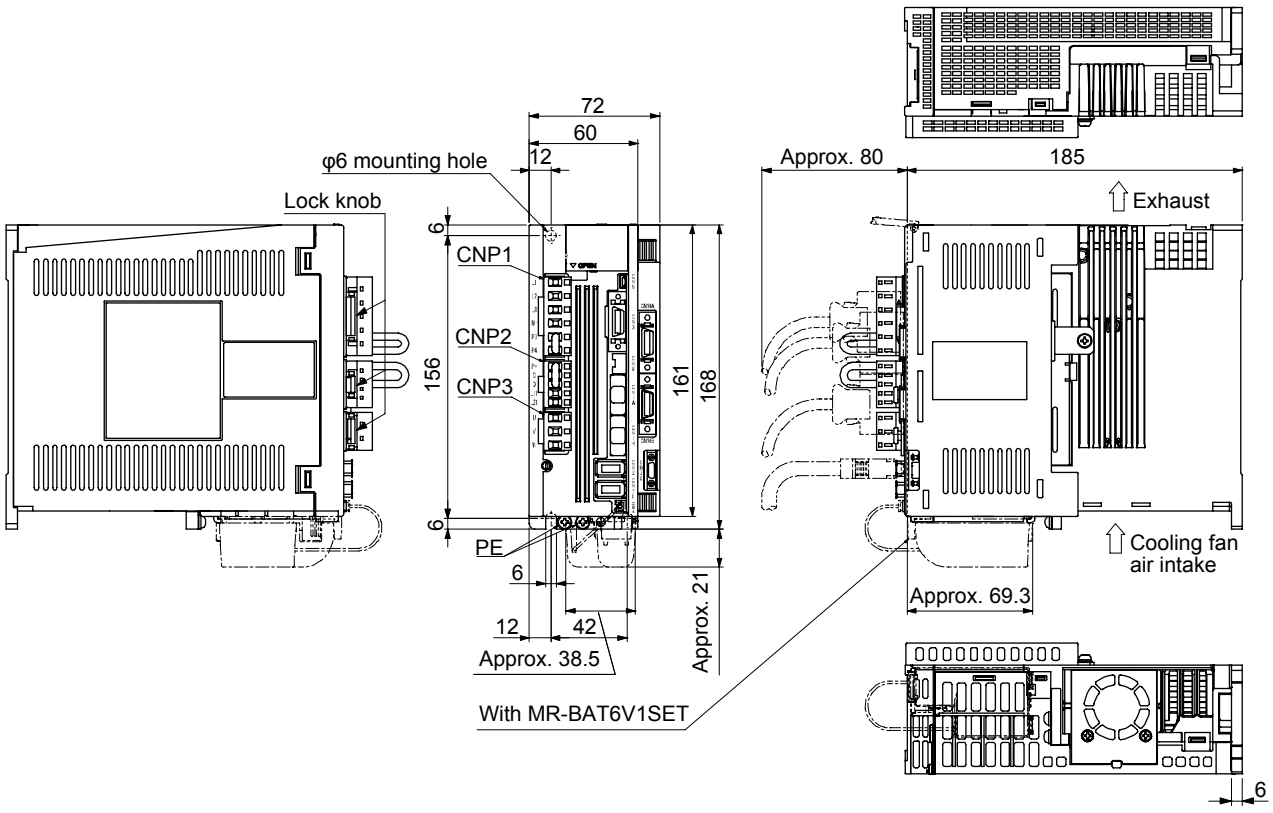
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(3) MR-J4-70B-RJ020/MR-J4-100B-RJ020

[Unit: mm]



Mass: 1.4 [kg] (servo amplifier only)

Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

Terminal

CNP1

L1
L2
L3
N-
P3
P4

CNP2

P+
C
D
L11
L21

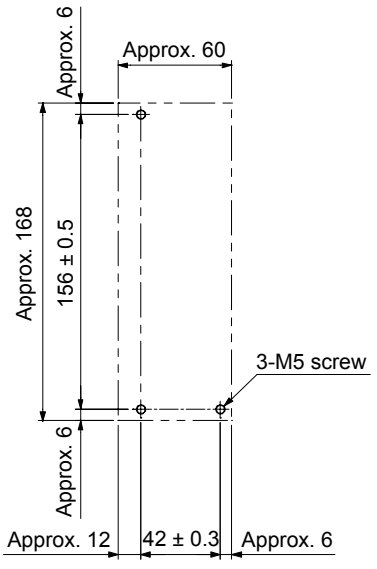
CNP3

U
V
W

PE

Screw size: M4

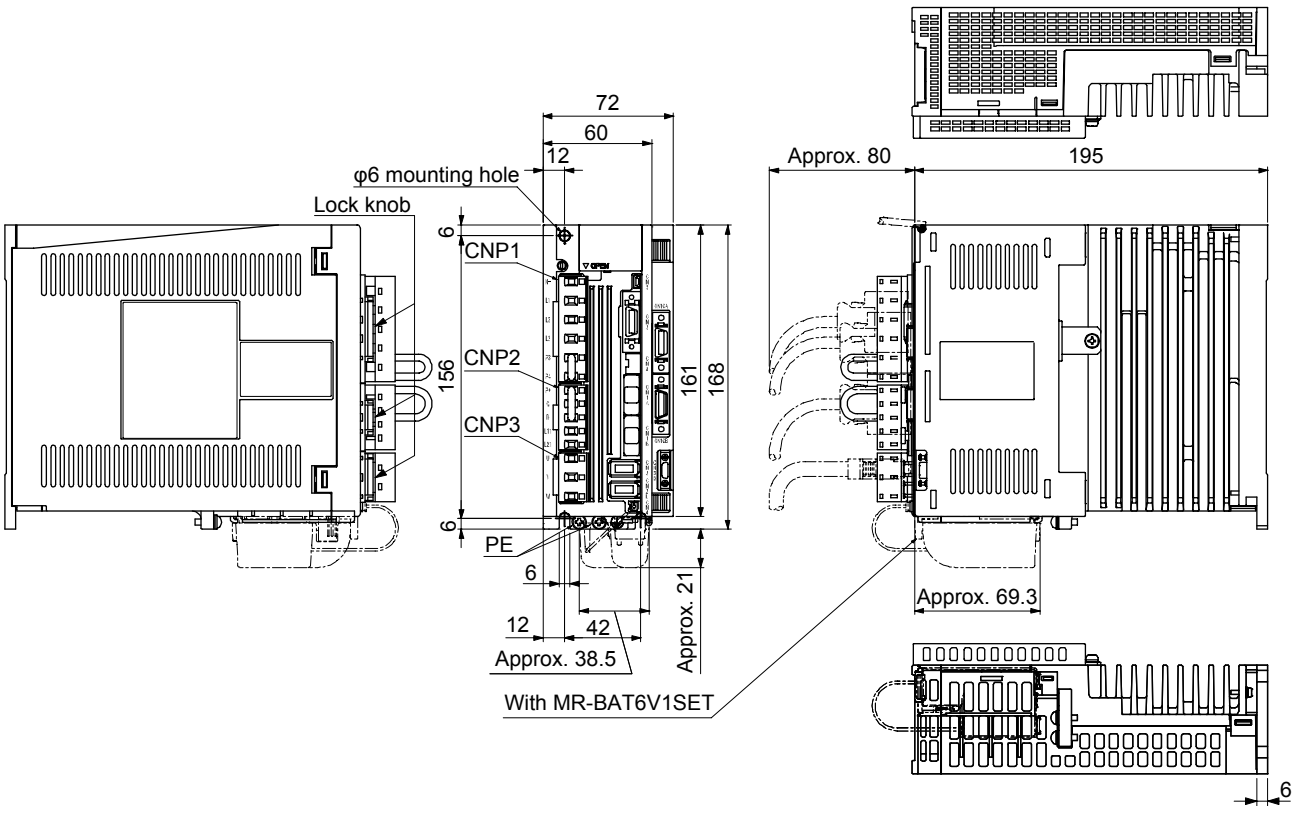
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(4) MR-J4-60B4-RJ020/MR-J4-100B4-RJ020

[Unit: mm]

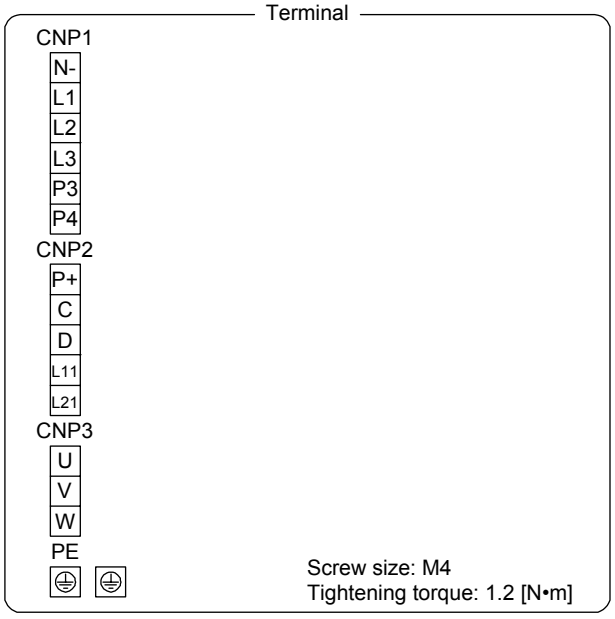


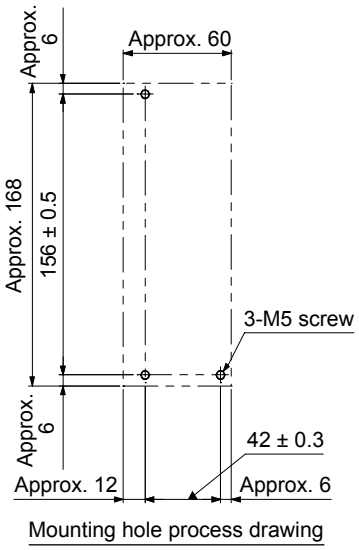
Mass: 1.7 [kg] (servo amplifier only)

Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

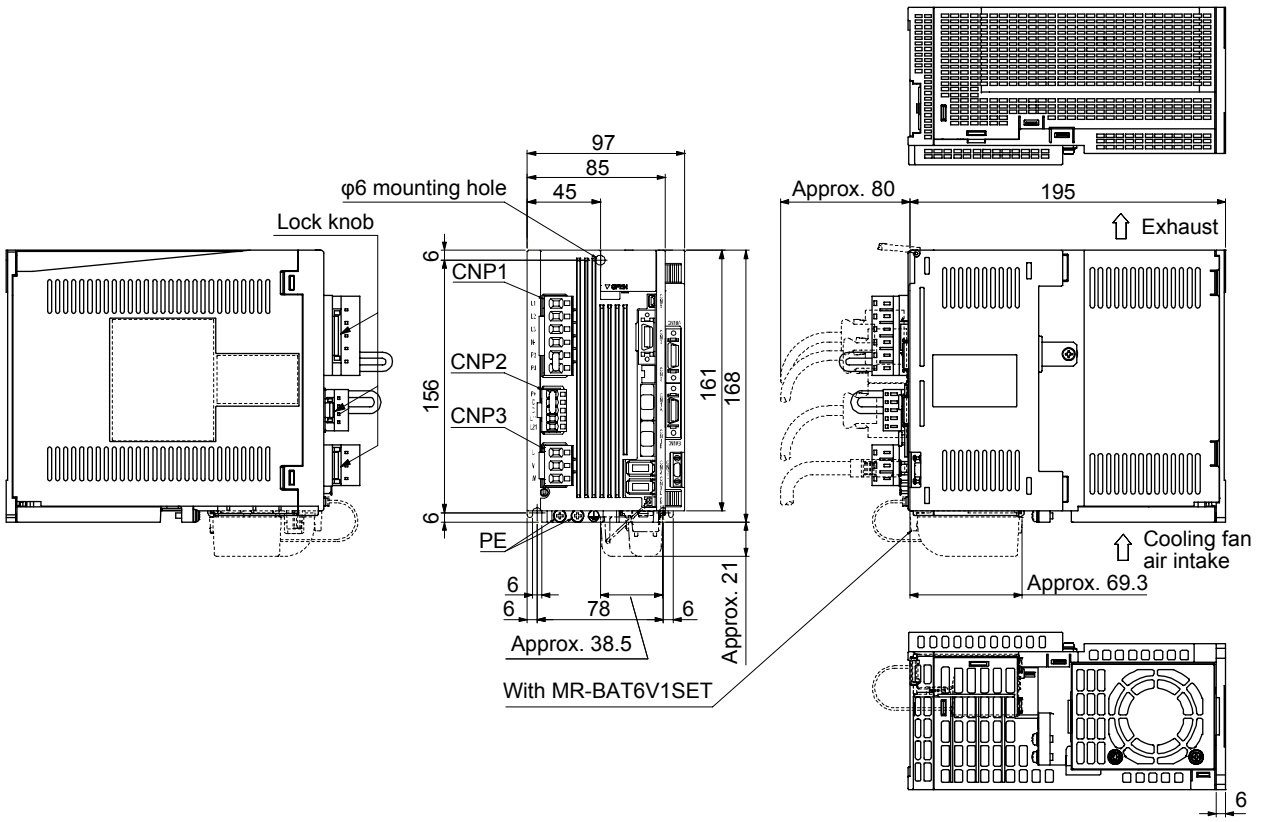




Mounting hole process drawing

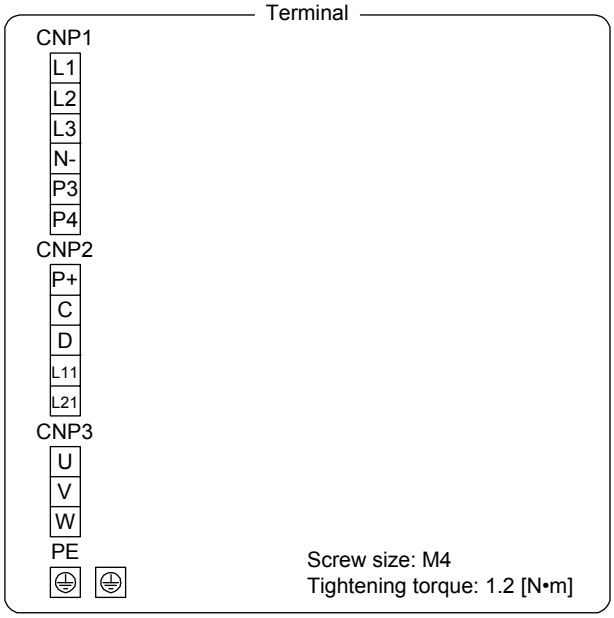
(5) MR-J4-200B-RJ020

[Unit: mm]

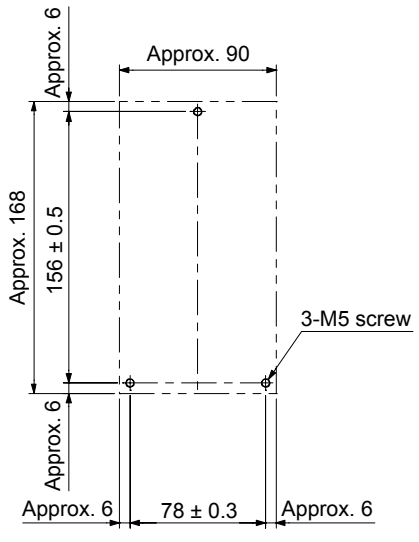


Mass: 2.1 [kg] (servo amplifier only)

Terminal



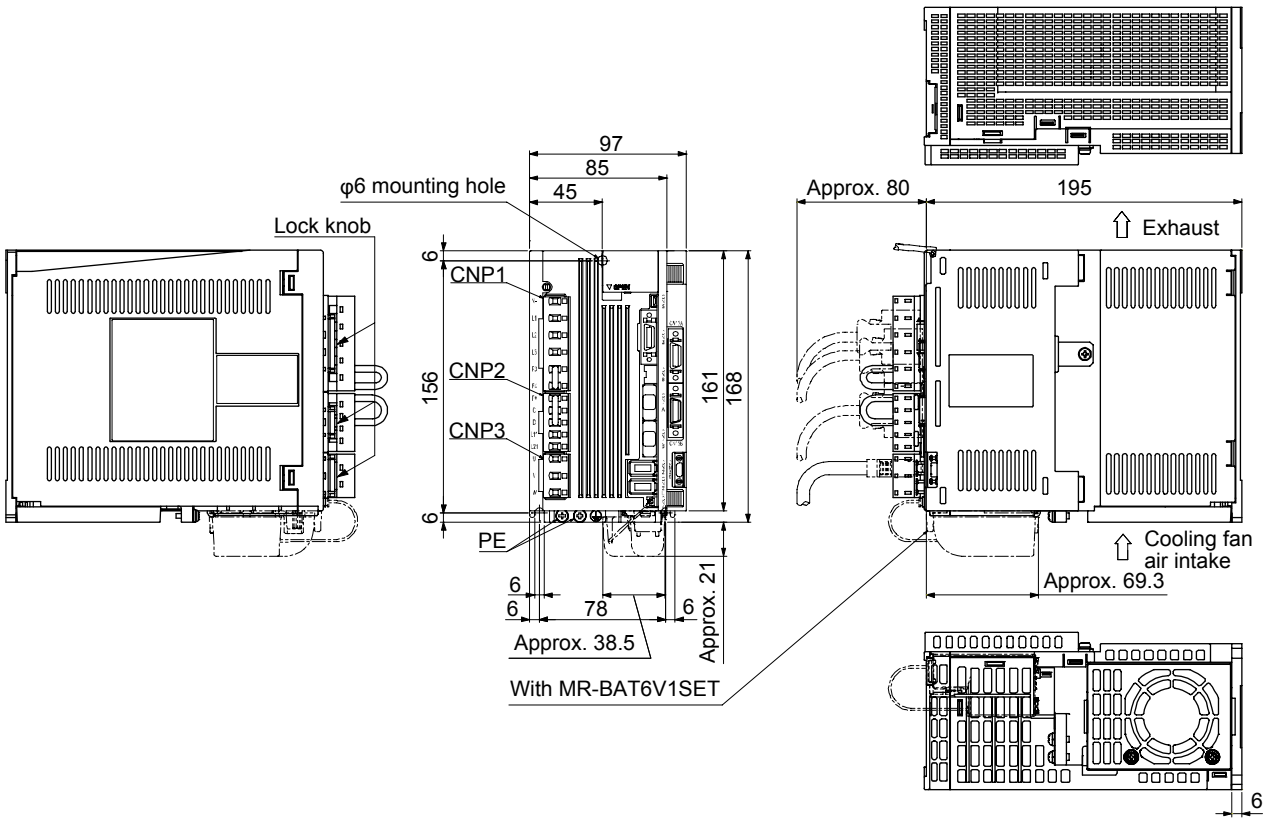
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(6) MR-J4-200B4-RJ020

[Unit: mm]



Mass: 2.1 [kg] (servo amplifier only)

Mounting screw

Screw size: M5

Tightening torque: 3.24 [N•m]

Terminal

CNP1

N-
L1
L2
L3
P3
P4

CNP2

P+
C
D
L11
L21

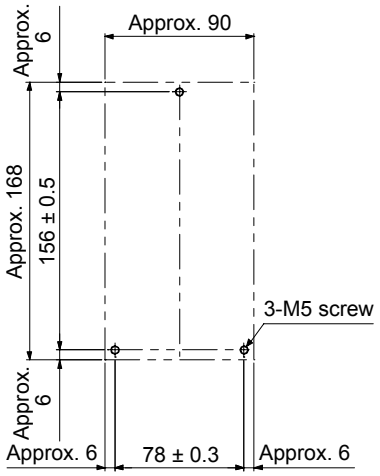
CNP3

U
V
W

PE

Screw size: M4

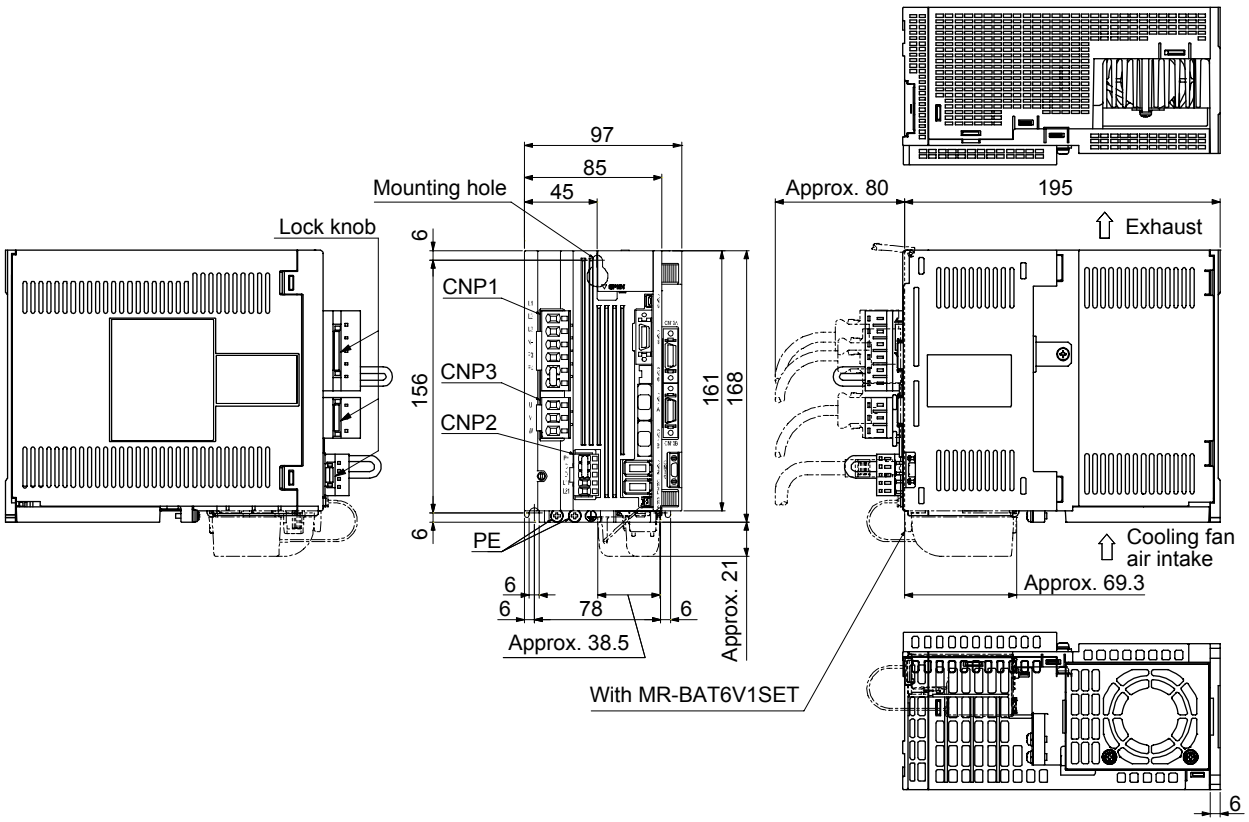
Tightening torque: 1.2 [N•m]



Mounting hole process drawing

(7) MR-J4-350B-RJ020

[Unit: mm]



Mass: 2.3 [kg] (servo amplifier only)

Terminal

CNP1
L1
L2
L3
N-
P3
P4

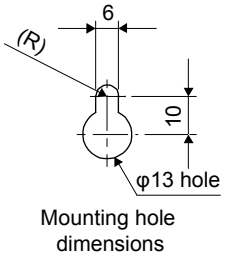
CNP2
P+
C
D
L11
L21

CNP3
U
V
W

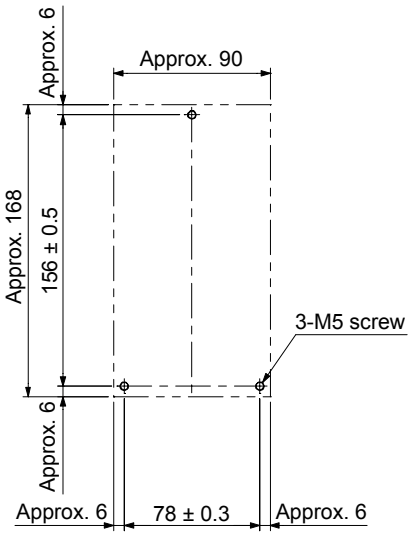
PE

Screw size: M4
Tightening torque: 1.2 [N•m]

Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



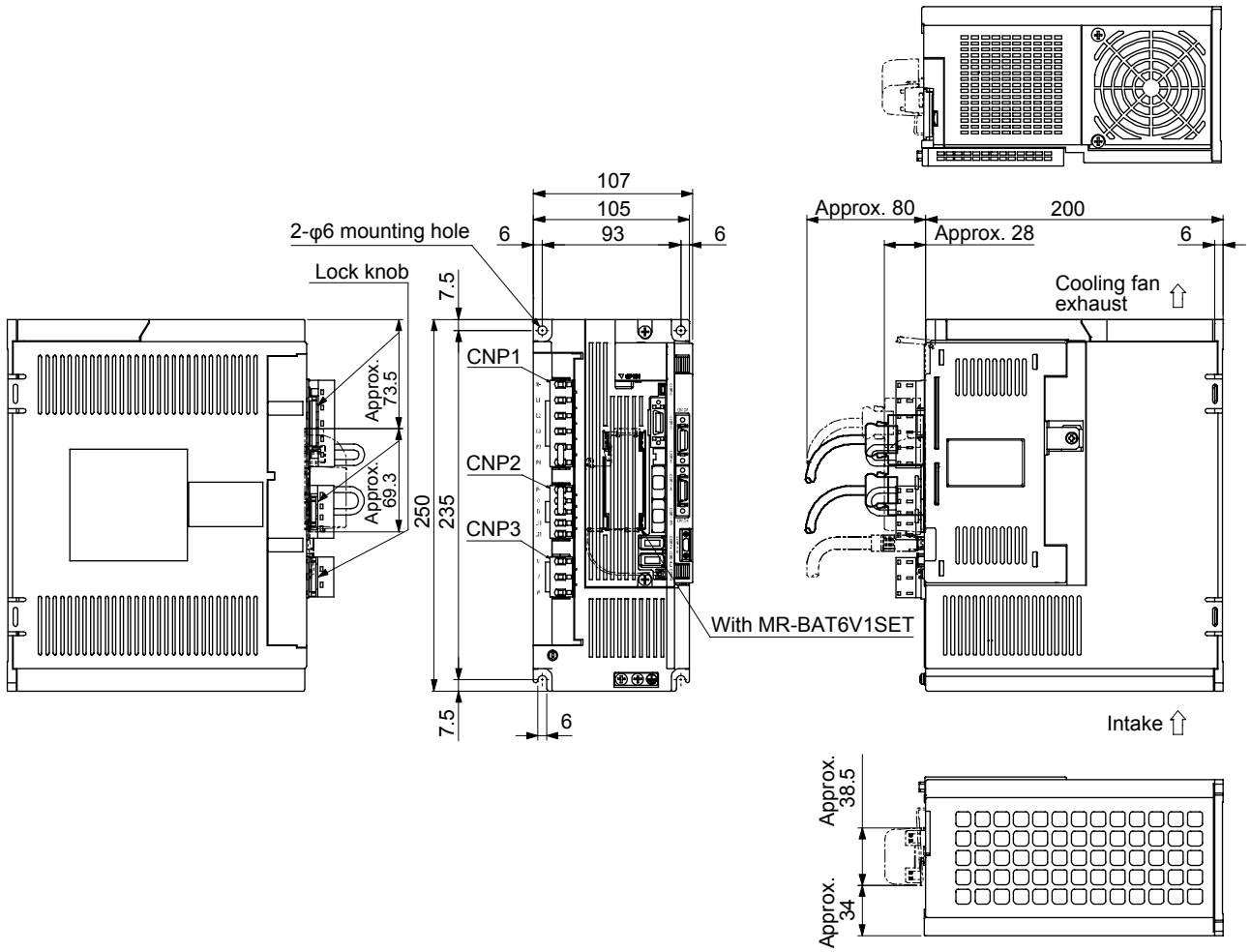
Mounting hole dimensions



Mounting hole process drawing

(8) MR-J4-350B4-RJ020

[Unit: mm]

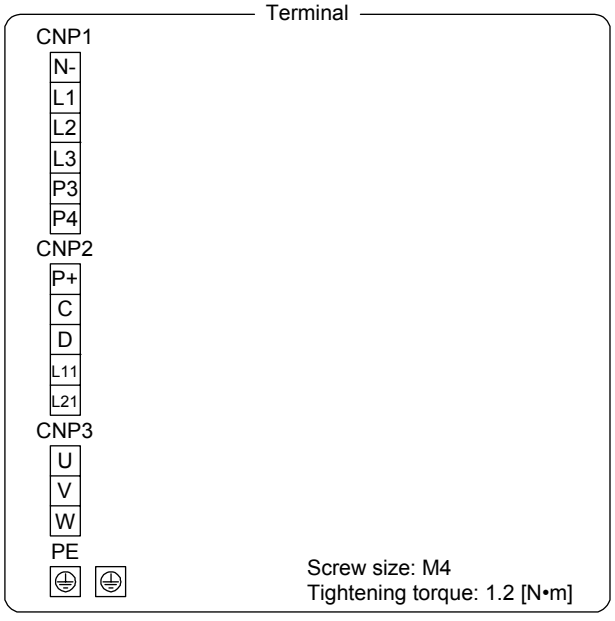


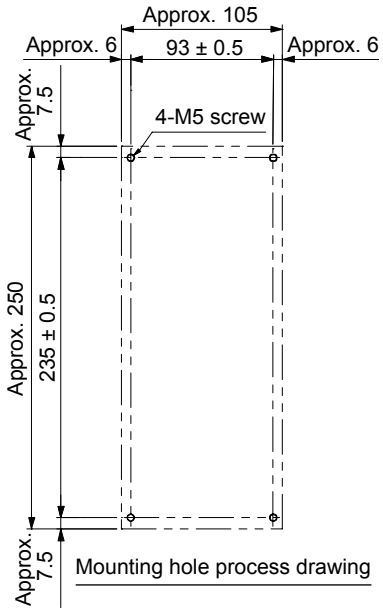
Mass: 3.6 [kg] (servo amplifier only)

Mounting screw

Screw size: M5

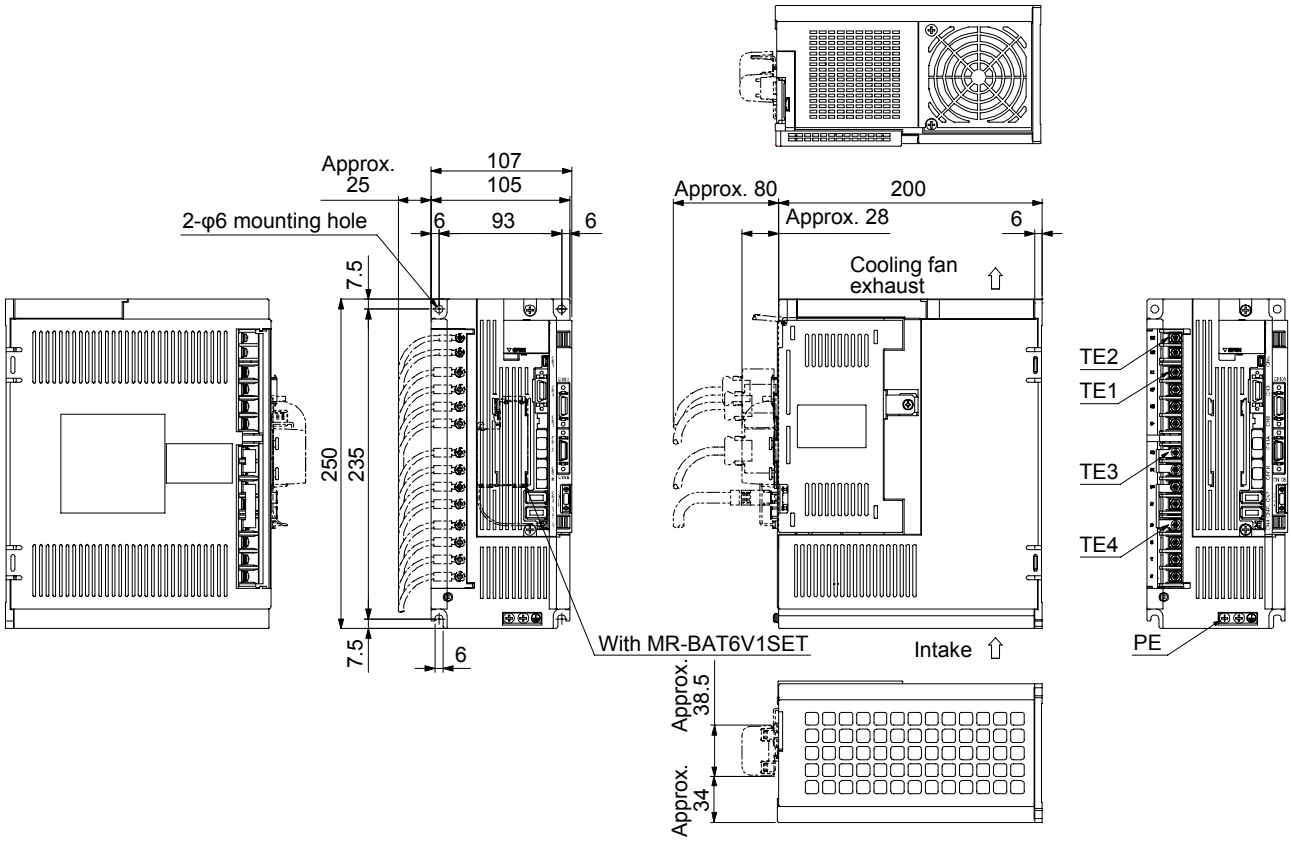
Tightening torque: 3.24 [N•m]





(9) MR-J4-500B-RJ020

[Unit: mm]

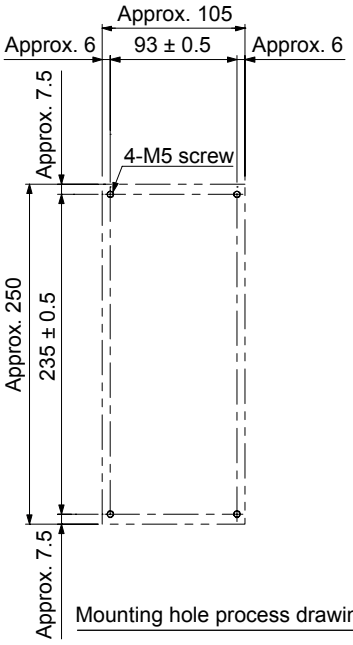


Mass: 4.0 [kg] (servo amplifier only)

Terminal

TE2	L11, L21	TE2 Screw size: M3.5 Tightening torque: 0.8 [N•m]
TE1	L1, L2, L3, N-	TE1 Screw size: M4 Tightening torque: 1.2 [N•m]
TE3	P3, P4, P+, C	TE3 Screw size: M4 Tightening torque: 1.2 [N•m]
TE4	D, U, V, W	TE4 Screw size: M4 Tightening torque: 1.2 [N•m]
PE	⏚ ⏚	PE Screw size: M4 Tightening torque: 1.2 [N•m]

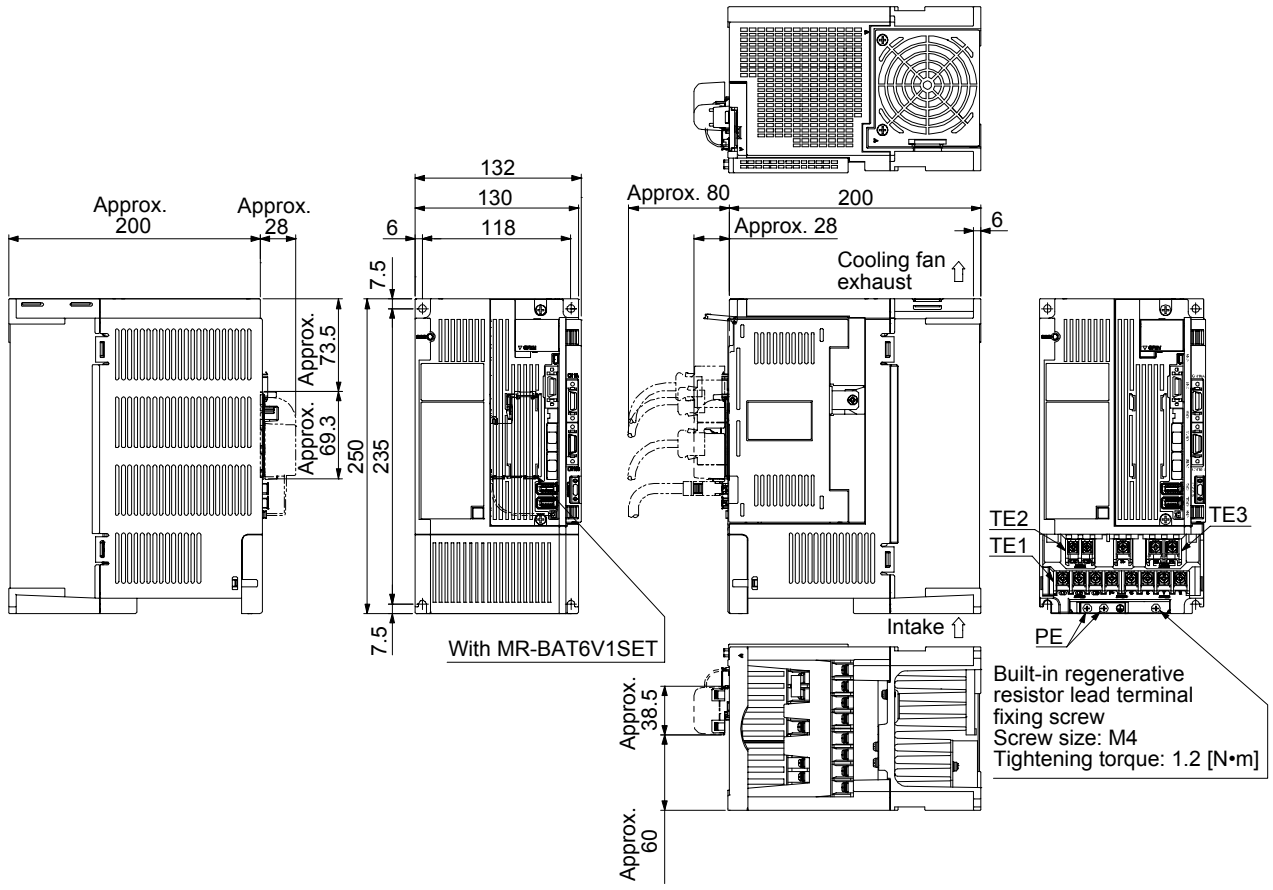
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(10) MR-J4-500B4-RJ020

[Unit: mm]



Mass: 4.3 [kg] (servo amplifier only)

Terminal

TE2 L11 L21 TE3 N- P3 P4

TE1 L1 L2 L3 P+ C U V W

PE ⏚ ⏚

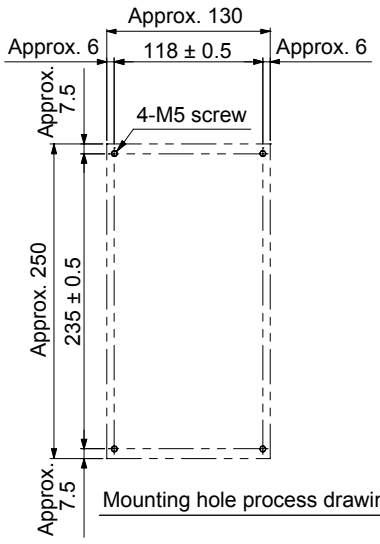
TE2 Terminal screw: M3.5
Tightening torque: 0.8 [N•m]

TE3 Terminal screw: M4
Tightening torque: 1.2 [N•m]

TE1 Terminal screw: M4
Tightening torque: 1.2 [N•m]

PE Screw size: M4
Tightening torque: 1.2 [N•m]

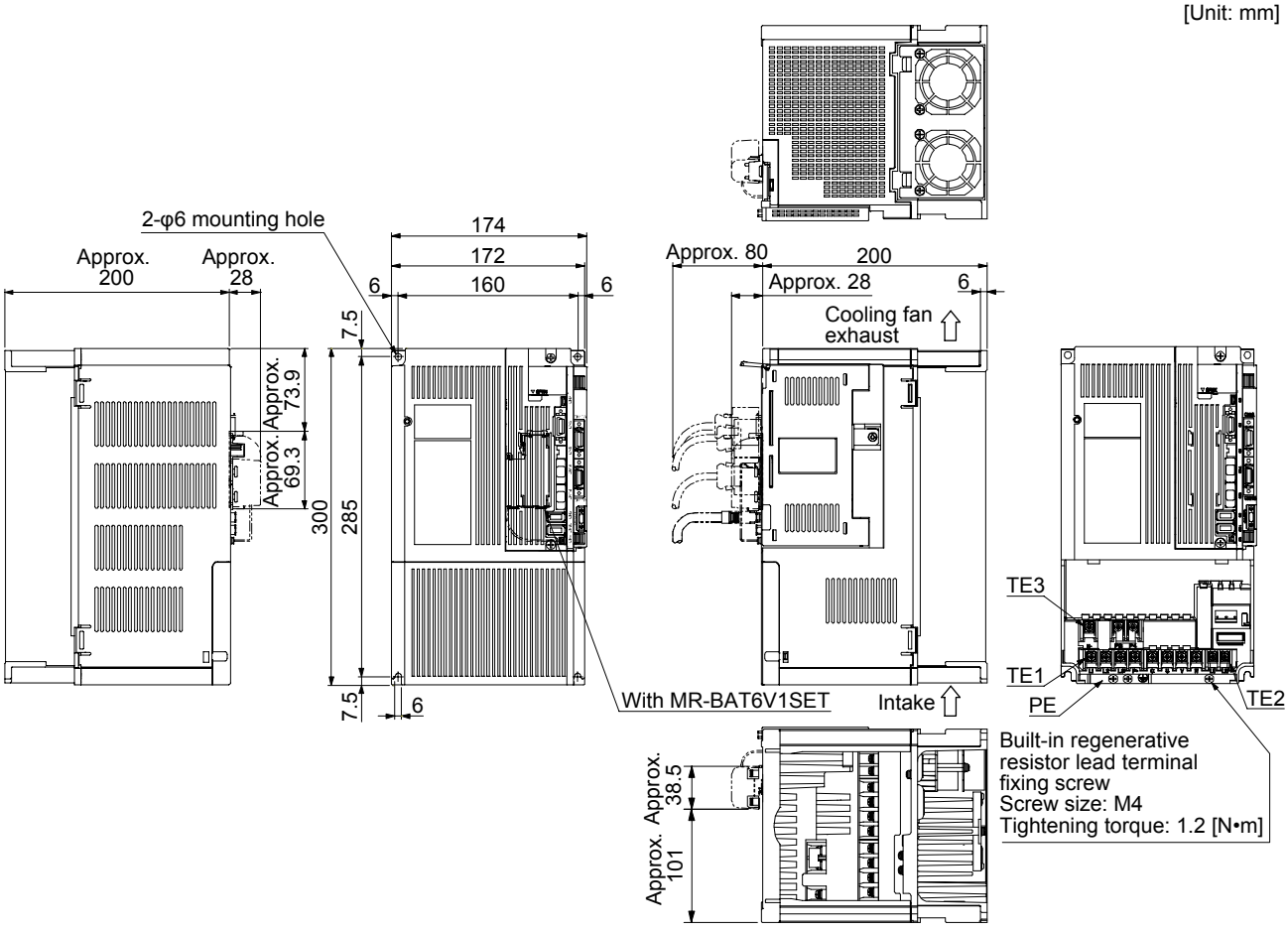
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(11) MR-J4-700B-RJ020/MR-J4-700B4-RJ020

[Unit: mm]



Servo amplifier	Mass [kg] (servo amplifier only)
MR-J4-700B-RJ020	6.2
MR-J4-700B4-RJ020	6.5

Terminal

TE3 N- P3 P4

TE1 L1 L2 L3 P+ C U V W TE2 L11 L21

PE

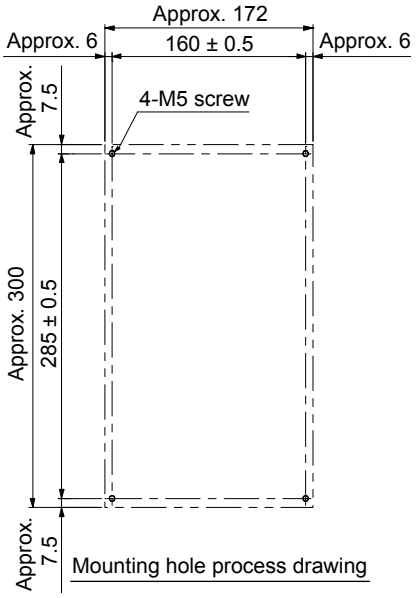
TE3 Screw size: M4
Tightening torque: 1.2 [N•m]

TE1 Screw size: M4
Tightening torque: 1.2 [N•m]

TE2 Screw size: M3.5
Tightening torque: 0.8 [N•m]

PE Screw size: M4
Tightening torque: 1.2 [N•m]

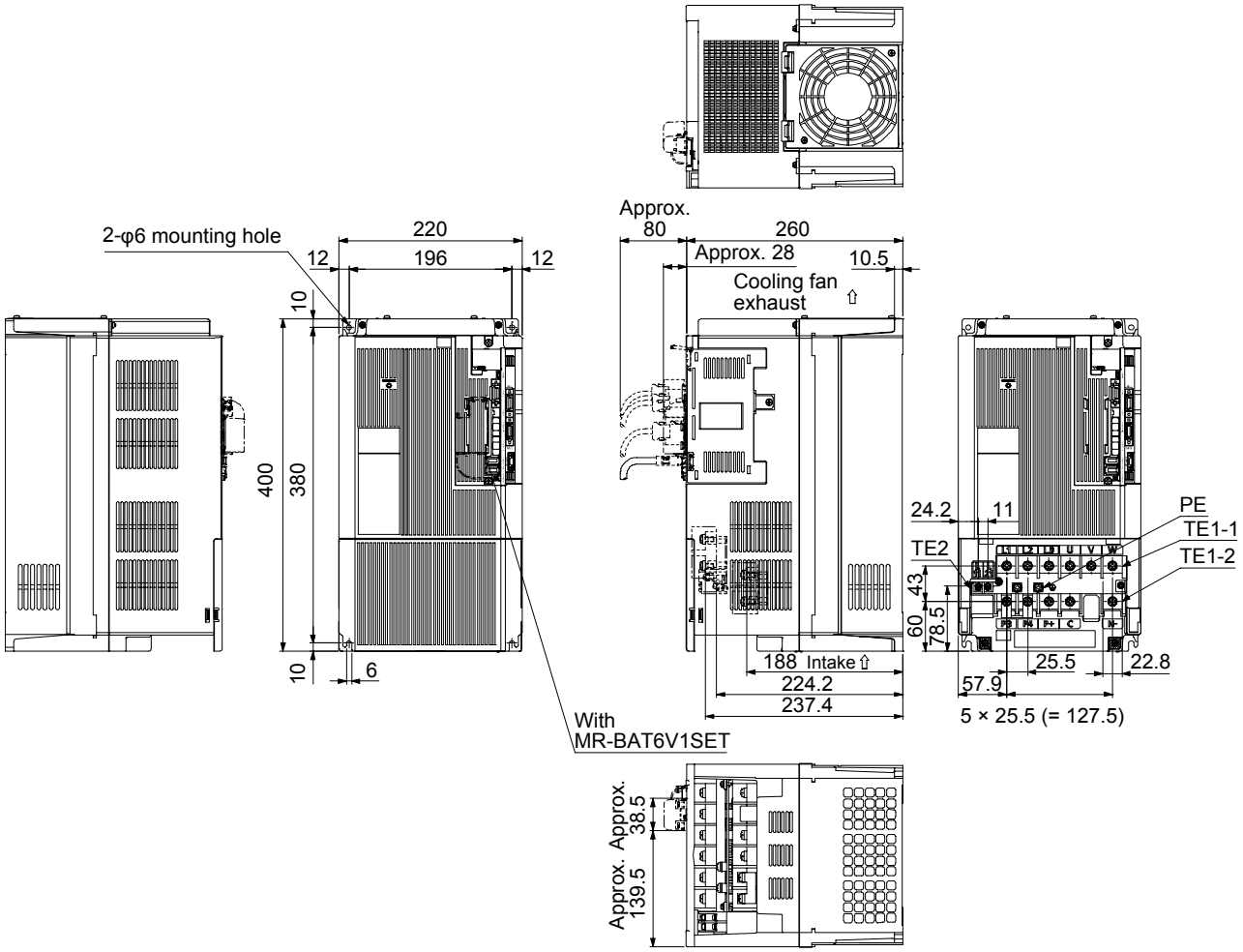
Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



Mounting hole process drawing

(12) MR-J4-11KB-RJ020/MR-J4-15KB-RJ020/MR-J4-11KB4-RJ020/MR-J4-15KB4-RJ020

[Unit: mm]



Mass: 13.4 [kg]

Terminal

TE1-1 L1 L2 L3 U V W

TE1-2 P3 P4 P+ C ⏥ N-

TE2 L11 L21

PE ⏚ ⏚

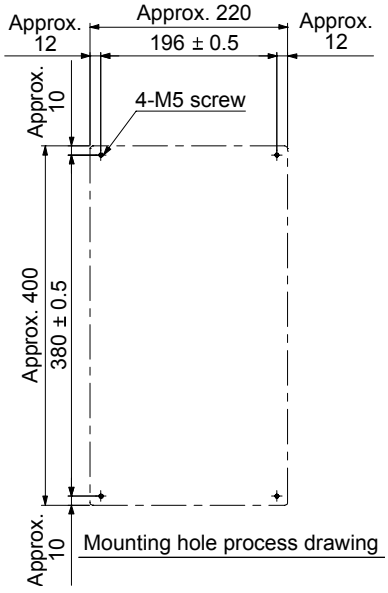
TE1-1 Screw size: M6
Tightening torque: 3.0 [N•m]

TE1-2 Screw size: M6
Tightening torque: 3.0 [N•m]

TE2 Screw size: M4
Tightening torque: 1.2 [N•m]

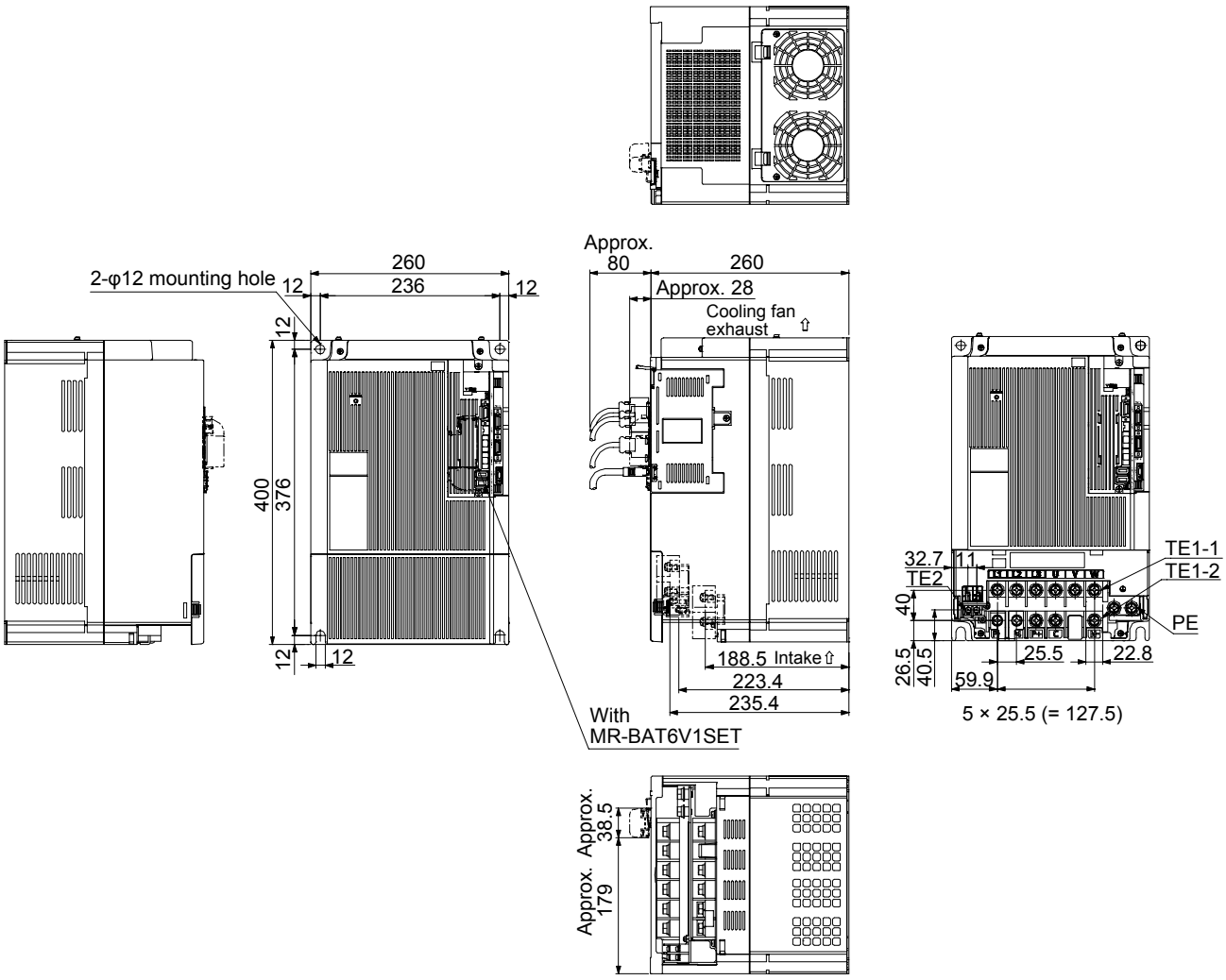
PE Screw size: M6
Tightening torque: 3.0 [N•m]

Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]



(13) MR-J4-22KB-RJ020/MR-J4-22KB4-RJ020

[Unit: mm]



Mass: 18.2 [kg]

Terminal

TE1-1 L1 L2 L3 U V W

TE1-2 P3 P4 P+ C N-

PE TE2 L11 L21

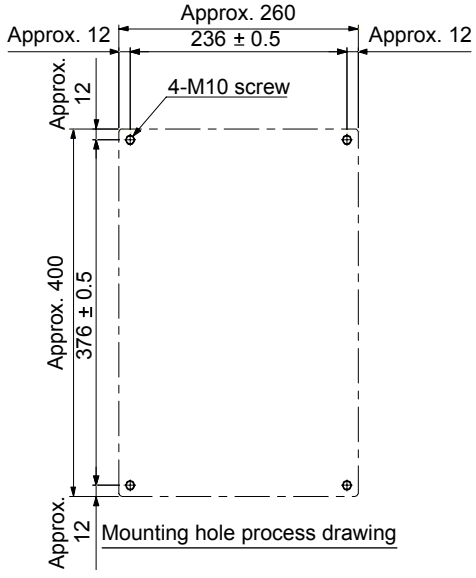
TE1-1 Screw size: M8
Tightening torque: 6.0 [N•m]

TE1-2 Screw size: M8
Tightening torque: 6.0 [N•m]

TE2 Screw size: M4
Tightening torque: 1.2 [N•m]

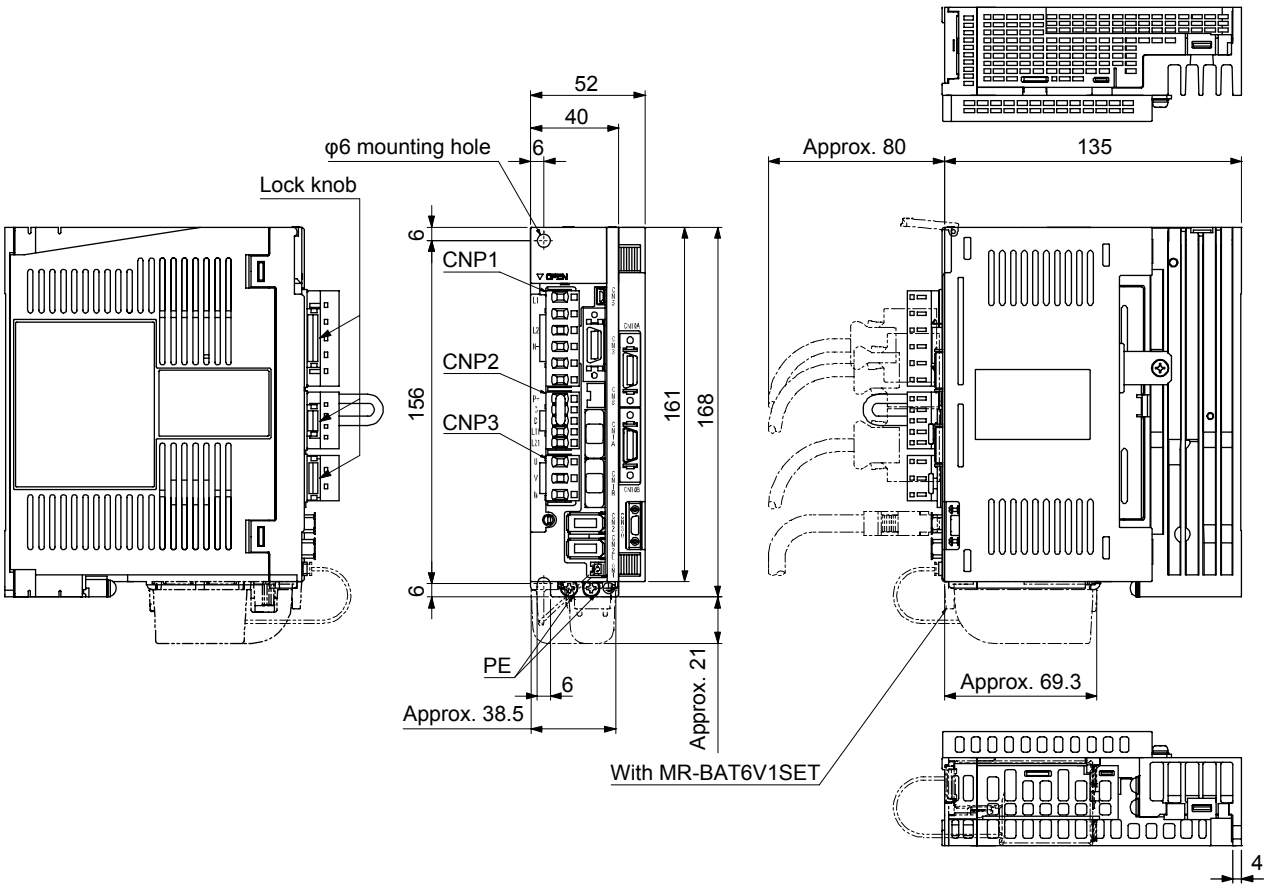
PE Screw size: M8
Tightening torque: 6.0 [N•m]

Mounting screw
Screw size: M10
Tightening torque: 26.5 [N•m]

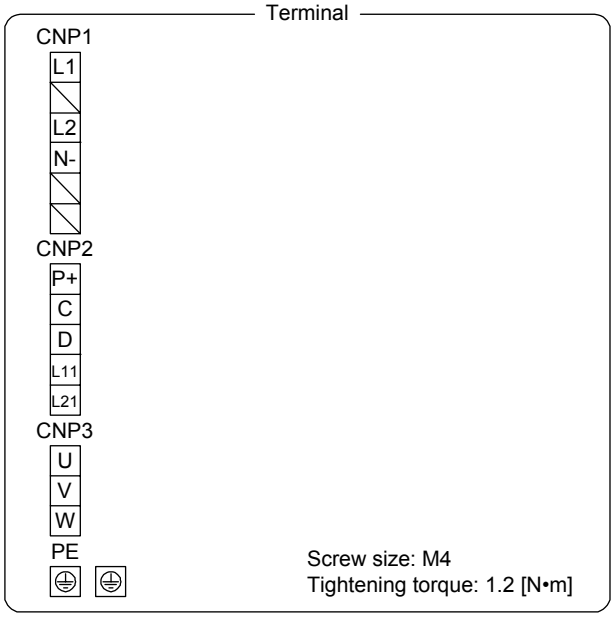


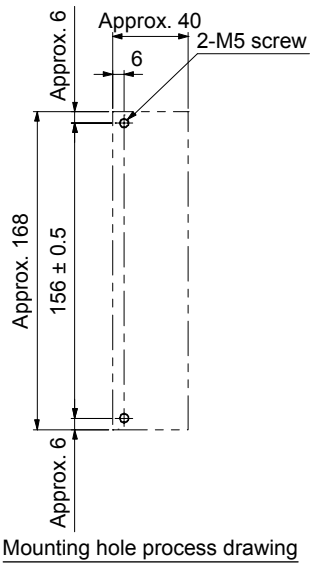
(14) MR-J4-10B1-RJ020/MR-J4-20B1-RJ020

[Unit: mm]



Mass: 0.8 [kg] (servo amplifier only)



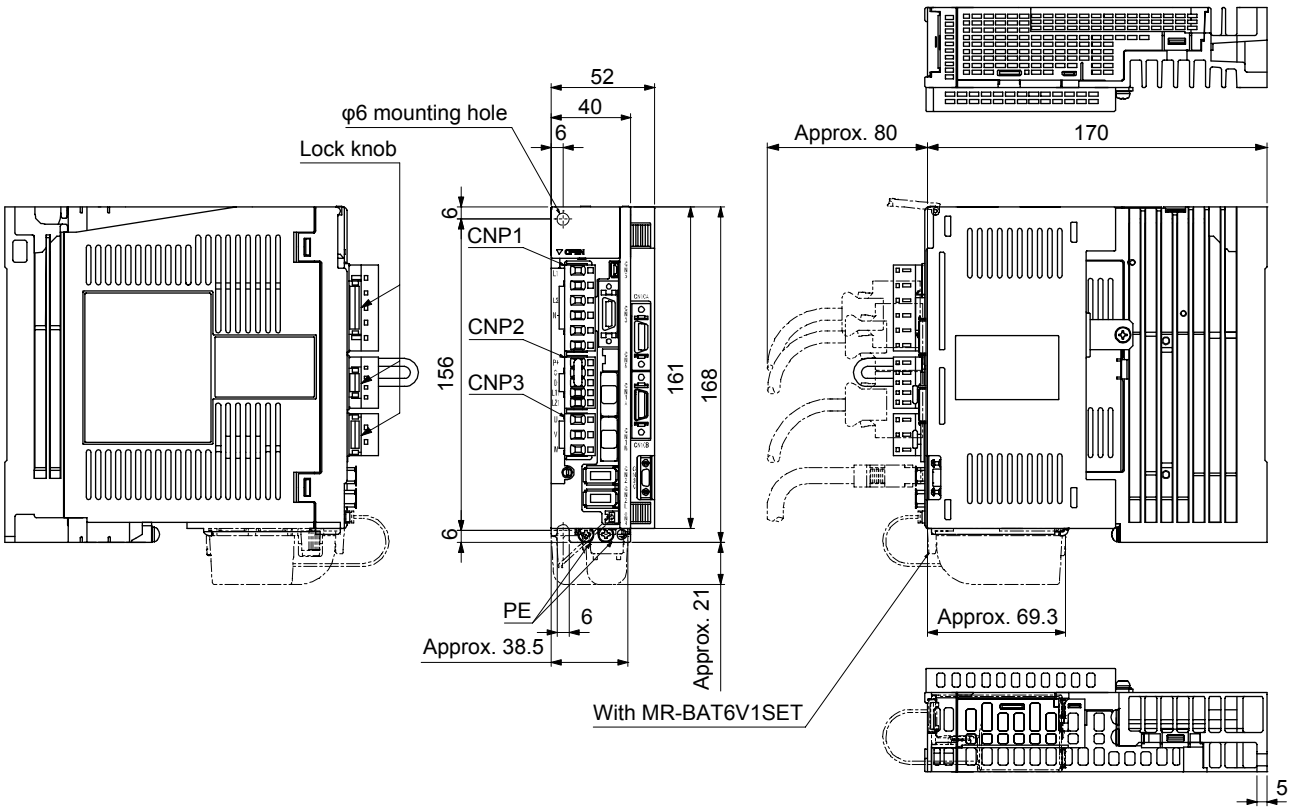


Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

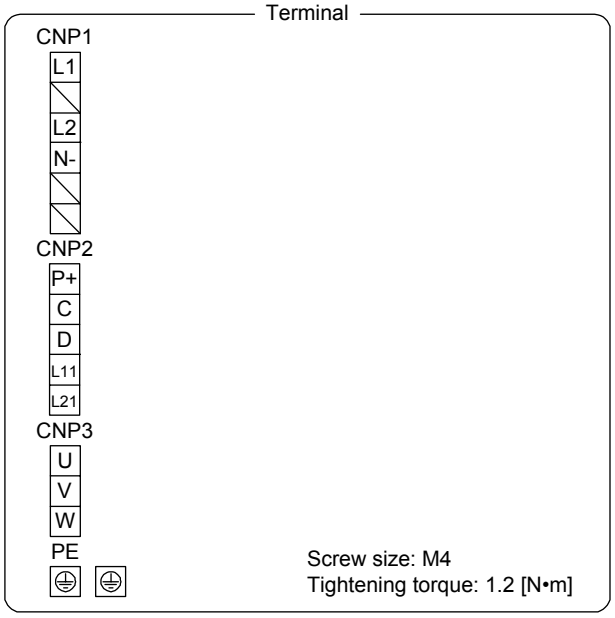
(15) MR-J4-40B1-RJ020

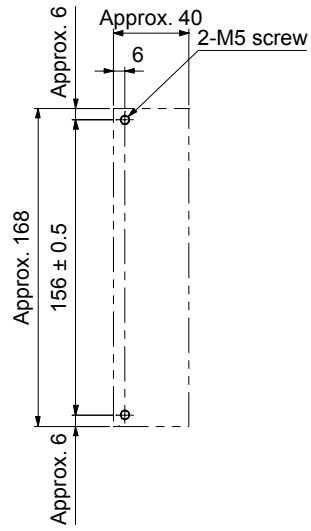
[Unit: mm]



Mass: 1.0 [kg] (servo amplifier only)

Mounting screw
Screw size: M5
Tightening torque: 3.24 [N•m]

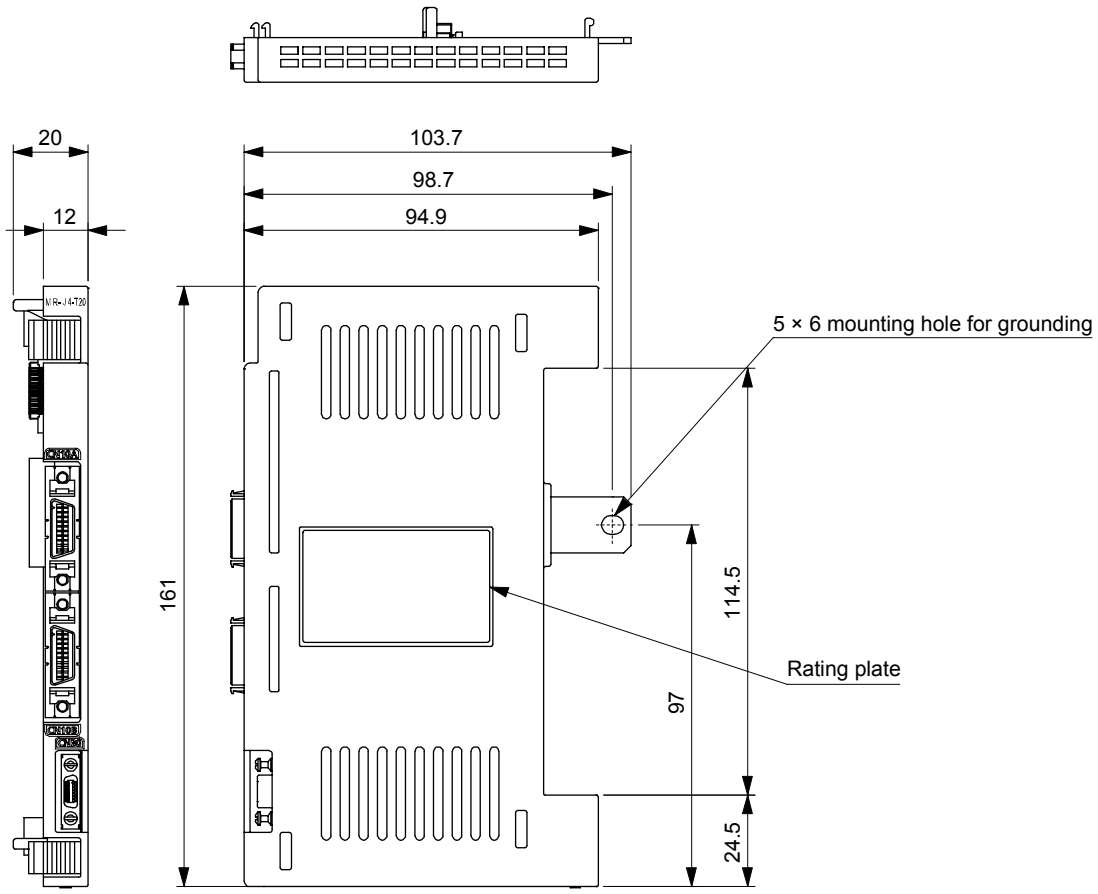




Mounting hole process drawing

9.2 MR-J4-T20

[Unit: mm]



Mass: 0.14 [kg]

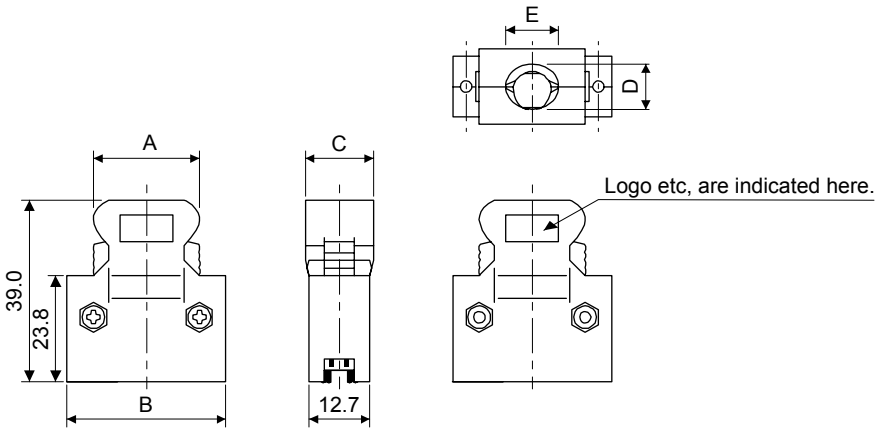
9.3 Connectors

9.3.1 Servo amplifier side connectors

(1) Miniature delta ribbon (MDR) system (3M) for CN3

(a) One-touch lock type

[Unit: mm]

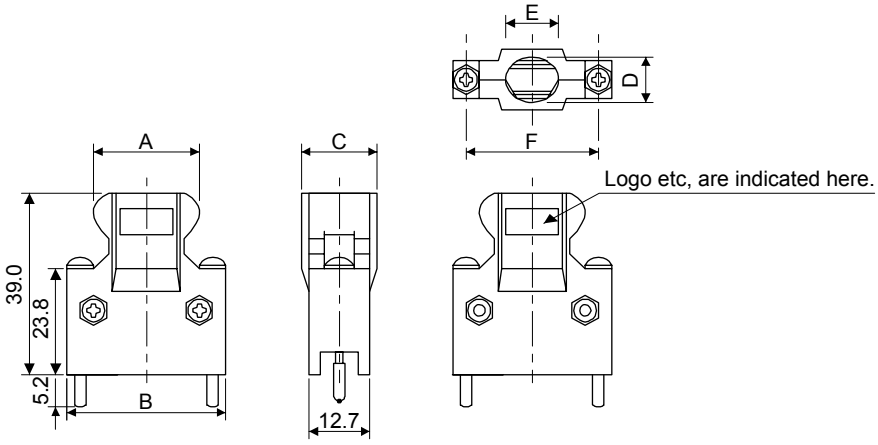


Connector	Shell kit	Variable dimensions				
		A	B	C	D	E
10120-3000PE	10320-52F0-008	22.0	33.3	14.0	10.0	12.0

(b) Jack screw M2.6 type

This is not available as option.

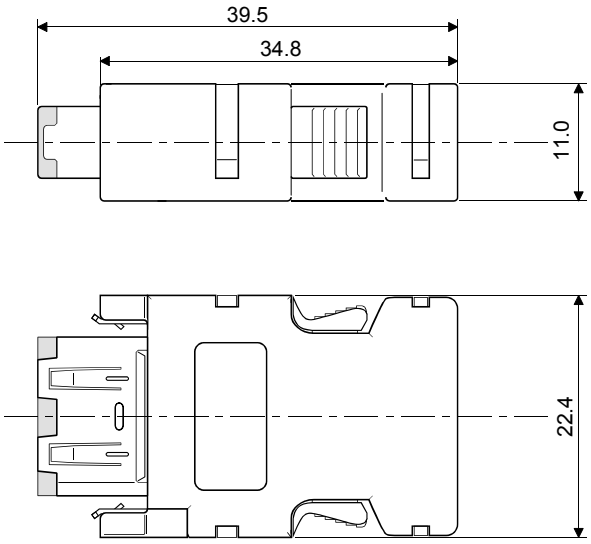
[Unit: mm]



Connector	Shell kit	Variable dimensions					
		A	B	C	D	E	F
10120-3000PE	10320-52A0-008	22.0	33.3	14.0	10.0	12.0	27.4

(2) SCR connector system (3M) for CN2
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008

[Unit: mm]

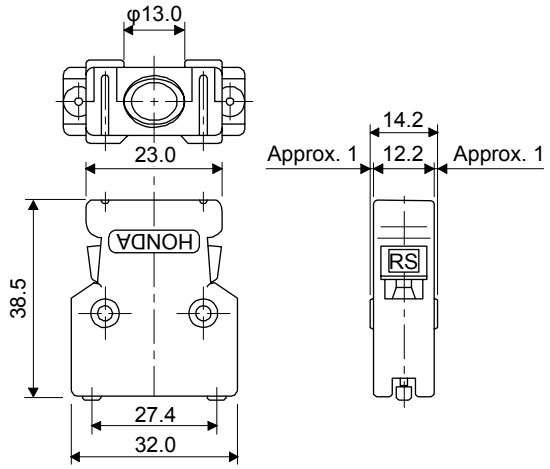


9.3.2 MR-J4-T20 connectors

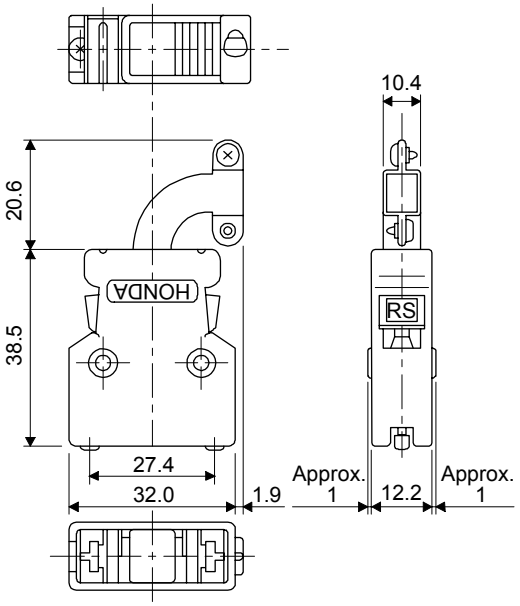
(1) Connector for CN10A/CN10B (Honda Tsushin Kogyo)

[Unit: mm]

PCR-LS20LA1



PCR-LS20LA1W



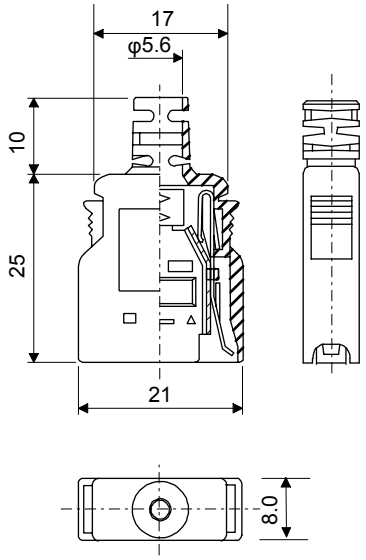
Number of pins	Model		
	Connector	Case	Crimping terminal
20	PCR-S20FS + (soldered type)	PCR-LS20LA1 PCR-LS20LA1W (Note)	FHAT-002A
	PCR-S20F (crimped type) (Note)		

Note. PCR-S20F and PCR-LS20LA1W are not options. They are to be supplied by the customer.

(2) Connector for CN30A (JAE)

[Unit: mm]

Connector: HDR-E14MG1+
Case: HDR-E14LPA5



Number of pins	Model		
	Connector	Case	(Note) Tool
14	HDR-E14MG1+	HDR-E14LPA5	Wire straightening tool: FHAT-0029 Crimping terminal: FHPT-0004C

Note. Not available from us. They are to be supplied by the customer.

10. CHARACTERISTICS

10.1 Overload protection characteristics

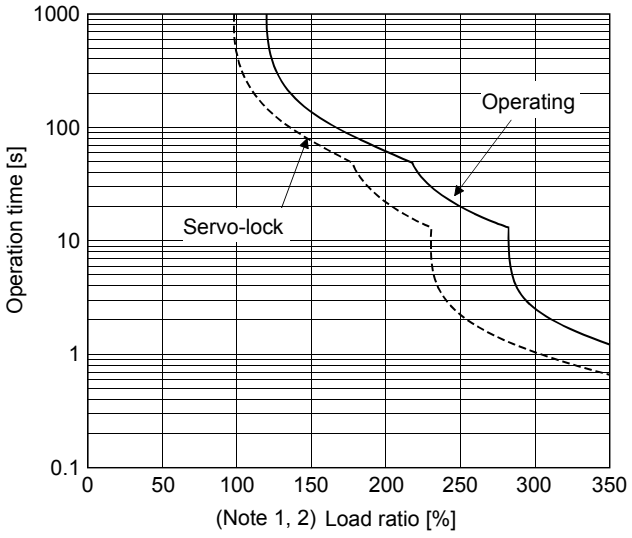
An electronic thermal is built in the servo amplifier to protect the servo motor, servo amplifier and servo motor power wires from overloads.
[AL. 50 Overload 1] occurs if an overload operation performed is above the electronic thermal protection curve shown in fig. 10.1. [AL. 51 Overload 2] occurs if the maximum current is applied continuously for several seconds due to machine collision, etc. Use the equipment on the left-side area of the continuous or broken line in the graph.
For the system where the unbalanced torque occurs, such as a vertical axis system, it is recommended that the unbalanced torque of the machine be kept at 70% or less of the motor's rated torque.
This servo amplifier has a servo motor overload protective function. (The servo motor overload current (full load current) is set on the basis of 115% rated current of the servo amplifier.)

The following table shows combinations of each servo motor and graph of overload protection characteristics.

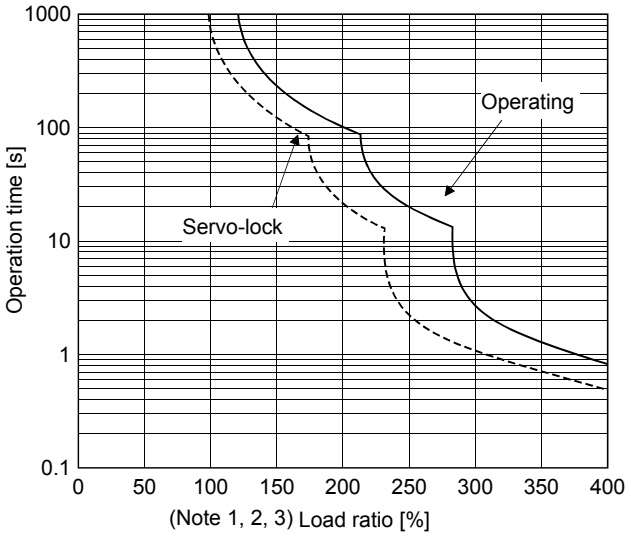
Servo motor							Graph of overload protection characteristics
HG-KR	HG-MR	HG-SR	HG-UR	HG-RR	HG-JR	HG-JR (When the maximum torque is 400%)	
053 13	053 13		72				Characteristics a
23 43 73	23 43 73	51 81 52 102			53 73 103	53	Characteristics b
		121 201 152 202 301 352	152 202	103 153 203	153 203 353	73 103 153 203	Characteristics c
		421 502 702	352 502	353 503	503 703	353 503	Characteristics d
					903 11K1M 15K1M 22K1M		Characteristics e
		524 1024			534 734 1034	534	Characteristics b
		1524 2024 3524			1534 2034 3534	734 1034 1534 2034	Characteristics c
		5024 7024			5034 7034	3534 5034	Characteristics d
					9034 11K1M4 15K1M4 22K1M4		Characteristics e

10. CHARACTERISTICS

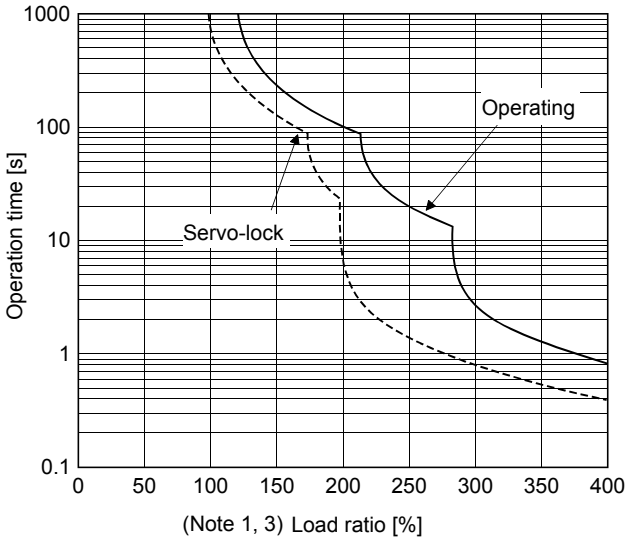
The following graphs show overload protection characteristics.



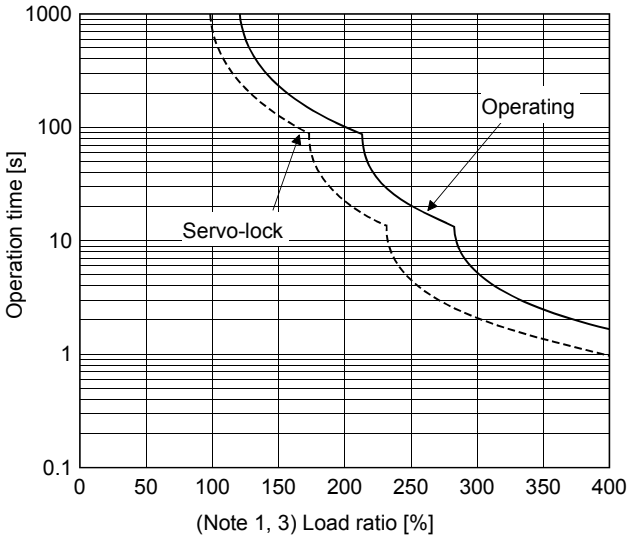
Characteristics a



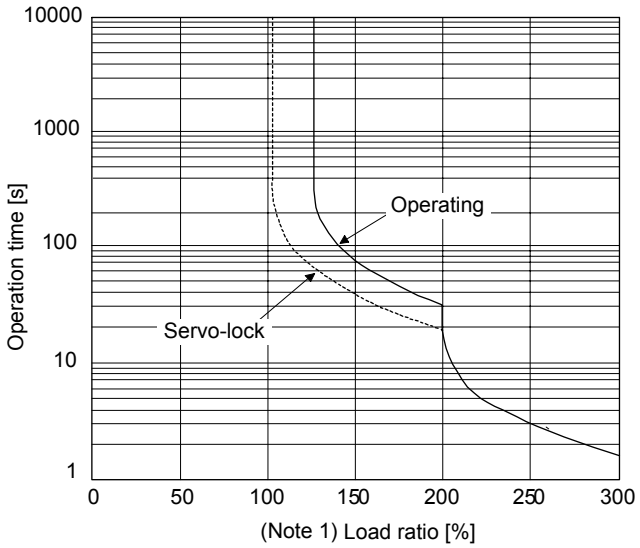
Characteristics b



Characteristics c



Characteristics d



Characteristics e

Note 1. If an operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo-lock status) or in a 30 r/min or less low-speed operation status, the servo amplifier may malfunction regardless of the electronic thermal protection.

2. The load ratio ranging from 300% to 350% applies to the HG-KR servo motor.
3. The operation time at the load ratio of 300% to 400% applies when the maximum torque of HG-JR servo motor is increased to 400% of rated torque.

Fig. 10.1 Electronic thermal protection characteristics

10.2 Power supply capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 10.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosed type cabinet, use the values in the table in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo-off according to the duty used during operation. When the servo motor is run at less than the rated speed, the power supply capacity will be smaller than the value in the table, but the servo amplifier's generated heat will not change.

Table 10.1 Power supply capacity and generated loss per servo motor at rated output

Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Servo amplifier generated heat [W]			Area required for heat dissipation [m^2]
			At rated output	At rated output [Generated heat in the cabinet when cooled outside the cabinet] (Note 3)	With servo-off	
MR-J4-10B-RJ020	HG-MR053	0.3	25		15	0.5
	HG-MR13	0.3	25		15	0.5
	HG-KR053	0.3	25		15	0.5
	HG-KR13	0.3	25		15	0.5
MR-J4-20B-RJ020	HG-MR23	0.5	25		15	0.5
	HG-KR23	0.5	25		15	0.5
MR-J4-40B-RJ020	HG-MR43	0.9	35		15	0.7
	HG-KR43	0.9	35		15	0.7
MR-J4-60B-RJ020	HG-SR52	1.0	40		15	0.8
	HG-SR51	1.0	40		15	0.8
	HG-JR53	1.0	40		15	0.8
MR-J4-70B-RJ020	HG-MR73	1.3	50		15	1.0
	HG-KR73	1.3	50		15	1.0
	HG-UR72	1.3	50		15	1.0
	HG-JR73	1.3	50		15	1.0
MR-J4-100B-RJ020	HG-SR102	1.7	50		15	1.0
	HG-SR81	1.5	50		15	1.0
	HG-JR73	1.3	50		15	1.0
	HG-JR103	1.7	50		15	1.0
MR-J4-200B-RJ020	HG-SR152	2.5	90		20	1.8
	HG-SR202	3.5	90		20	1.8
	HG-SR121	2.1	90		20	1.8
	HG-SR201	3.5	90		20	1.8
	HG-RR103	1.7	50		15	1.0
	HG-RR153	2.5	90		20	1.8
	HG-UR152	2.5	90		20	1.8
	HG-JR153	2.5	90		20	1.8
	HG-JR203	3.5	90		20	1.8
MR-J4-350B-RJ020	HG-SR352	5.5	130		20	2.6
	HG-SR301	4.8	120		20	2.4
	HG-RR203	3.5	90		20	1.8
	HG-UR202	3.5	90		20	1.8
	HG-JR353	5.5	160		20	2.7

Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Servo amplifier generated heat [W]			Area required for heat dissipation [m^2]
			At rated output	At rated output [Generated heat in the cabinet when cooled outside the cabinet] (Note 3)	With servo-off	
MR-J4-500B-RJ020	HG-SR502	7.5	195		25	3.9
	HG-SR421	6.3	160		25	3.2
	HG-RR353	5.5	135		25	2.7
	HG-RR503	7.5	195		25	3.9
	HG-UR352	5.5	195		25	3.9
	HG-UR502	7.5	195		25	3.9
	HG-JR503	7.5	195		25	3.9
MR-J4-700B-RJ020	HG-SR702	10	300		25	6.0
	HG-JR703	10	300		25	6.0
MR-J4-11KB-RJ020	HG-JR903	13	435	130	45	8.7
	HG-JR11K1M	16	530	160	45	11.0
MR-J4-15KB-RJ020	HG-JR15K1M	22	640	195	45	13.0
MR-J4-22KB-RJ020	HG-JR22K1M	33	850	260	55	17.0
MR-J4-60B4-RJ020	HG-SR524	1.0	40		18	0.8
	HG-JR534	1.0	40		18	0.8
MR-J4-100B4-RJ020	HG-SR1024	1.7	60		18	1.2
	HG-JR734	1.3	60		18	1.2
	HG-JR1034	1.7	60		18	1.2
MR-J4-200B4-RJ020	HG-SR1524	2.5	90		20	1.8
	HG-SR2024	3.5	90		20	1.8
	HG-JR1534	2.5	90		20	1.8
	HG-JR2034	3.5	90		20	1.8
MR-J4-350B4-RJ020	HG-SR3524	5.5	130		20	2.6
	HG-JR3534	5.5	160		20	2.7
MR-J4-500B4-RJ020	HG-SR5024	7.5	195		25	3.9
	HG-JR5034	7.5	195		25	3.9
MR-J4-700B4-RJ020	HG-SR7024	10	300		25	6.0
	HG-JR7034	10	300		25	6.0
MR-J4-11KB4-RJ020	HG-JR9034	13	435	130	45	8.7
	HG-JR11K1M4	16	530	160	45	11.0
MR-J4-15KB4-RJ020	HG-JR15K1M4	22	640	195	45	13.0
MR-J4-22KB4-RJ020	HG-JR22K1M4	33	850	260	55	17.0
MR-J4-10B1-RJ020	HG-MR053	0.3	25		15	0.5
	HG-MR13	0.3	25		15	0.5
	HG-KR053	0.3	25		15	0.5
	HG-KR13	0.3	25		15	0.5
MR-J4-20B1-RJ020	HG-MR23	0.5	25		15	0.5
	HG-KR23	0.5	25		15	0.5
MR-J4-40B1-RJ020	HG-MR43	0.9	35		15	0.7
	HG-KR43	0.9	35		15	0.7

Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value is applicable when the power factor improving AC reactor or power factor improving DC reactor are not used.

2. Heat generated during regeneration is not included in the servo amplifier-generated heat. To calculate heat generated by the regenerative option, refer to section 11.2.

3. This value is applicable when the servo amplifier is cooled by using the heat sink outside mounting attachment.

(2) Heat dissipation area for an enclosed type cabinet

The enclosed type cabinet (hereafter called the cabinet) which will contain the servo amplifier should be designed to ensure that its temperature rise is within +10 ˚C at the ambient temperature of 40 ˚C. (With an approximately 5 ˚C safety margin, the system should operate within a maximum 55 ˚C limit.) The necessary cabinet heat dissipation area can be calculated by equation 10.1.

$$A = \frac{P}{K \cdot \Delta T} \quad \cdots\cdots (10.1)$$

A: Heat dissipation area [m2]
P: Loss generated in the cabinet [W]
ΔT: Difference between the internal and ambient temperatures [˚C]
K: Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with equation 10.1, assume that P is the sum of all losses generated in the cabinet. Refer to table 10.1 for heat generated by the servo amplifier. "A" indicates the effective area for heat dissipation, but if the cabinet is directly installed on an insulated wall, that extra amount must be added to the cabinet's surface area. The required heat dissipation area will vary with the conditions in the cabinet. If convection in the cabinet is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the cabinet and the use of a cooling fan should be considered. Table 10.1 lists the cabinet dissipation area for each servo amplifier (guideline) when the servo amplifier is operated at the ambient temperature of 40 ˚C under rated load.

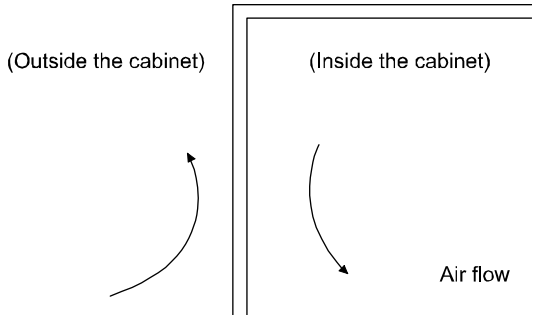


Fig. 10.2 Temperature distribution in an enclosed type cabinet

When air flows along the outer wall of the cabinet, effective heat exchange will be possible, because the temperature slope inside and outside the cabinet will be steeper.

10.3 Dynamic brake characteristics

POINT

- Do not use the dynamic brake to stop in a normal operation as it is the function to stop in emergency.
- For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.
- Be sure to enable EM1 (Forced stop) after servo motor stops when using EM1 (Forced stop) frequently in other than emergency.
- Servo motors for MR-J4 may have the different coasting distance from that of the previous model.
- The electronic dynamic brake operates in the initial state for the HG series servo motors of 600 W or smaller capacity. The time constant "τ" for the electronic dynamic brake will be shorter than that of normal dynamic brake. Therefore, coasting distance will be longer than that of normal dynamic brake. For how to set the electronic dynamic brake, refer to [Pr. 39] and [Pr. 56].

10.3.1 Dynamic brake operation

(1) Calculation of coasting distance

Fig. 10.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use equation 10.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to (2) of this section.)

A working part generally has a friction force. Therefore, actual coasting distance will be shorter than a maximum coasting distance calculated with the following equation.

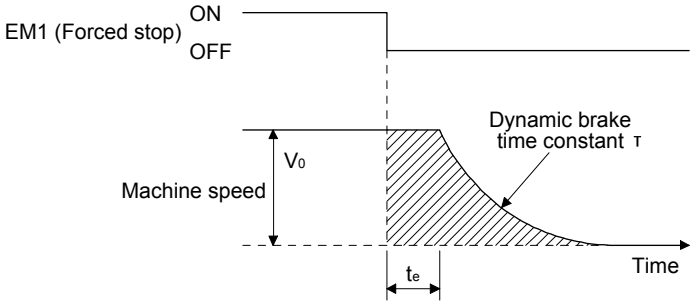


Fig. 10.3 Dynamic brake operation diagram

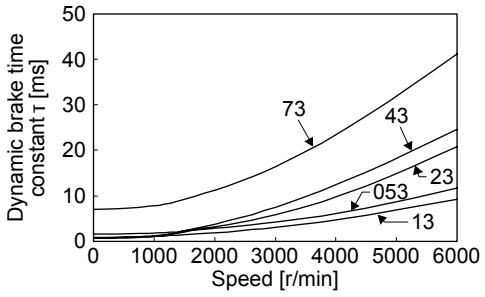
$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad \cdots\cdots (10.2)$$

L_{max} : Maximum coasting distance ····· [mm]
V_0 : Machine's fast feed speed ····· [mm/min]
J_M : Moment of inertia of the servo motor ····· [× 10^{-4} kg•m^2]
J_L : Load moment of inertia converted into equivalent value on servo motor shaft ····· [× 10^{-4} kg•m^2]
τ : Dynamic brake time constant ····· [s]
t_e : Delay time of control section ····· [s]
For 7 kW or lower servo, there is internal relay delay time of about 10 ms. For 11 kW to 22 kW servo, there is delay caused by magnetic contactor built into the external dynamic brake (about 50 ms) and delay caused by the external relay.

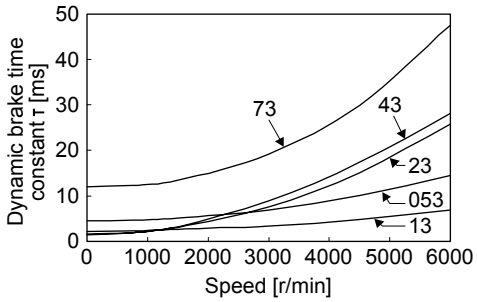
(2) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for equation 10.2.

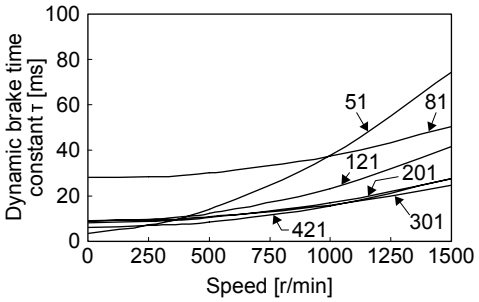
(a) 200 V class



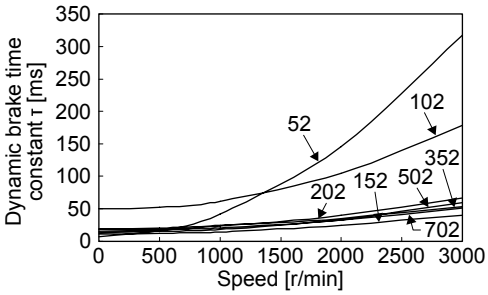
HG-MR series



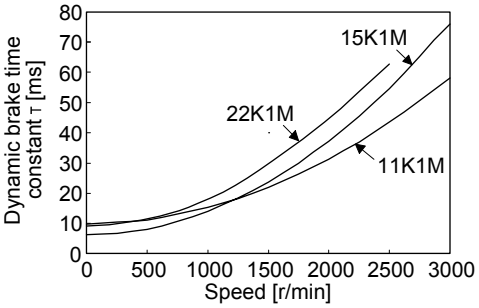
HG-KR series



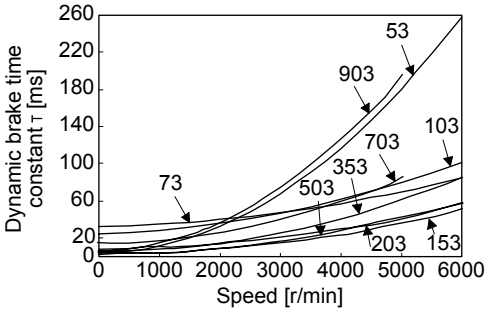
HG-SR1000 r/min series



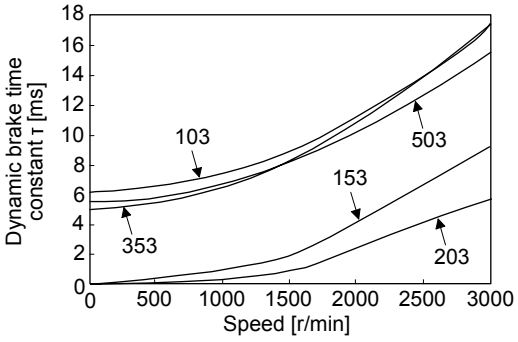
HG-SR2000 r/min series



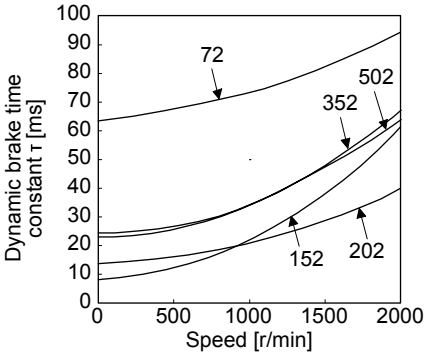
HG-JR1500 r/min series



HG-JR3000 r/min series

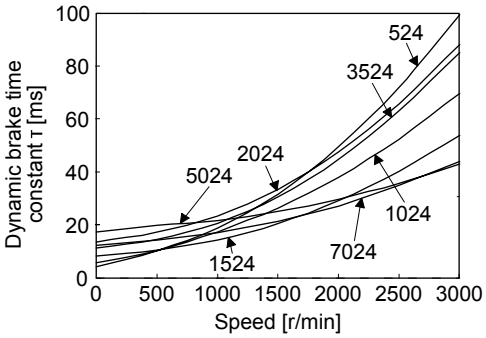


HG-RR series

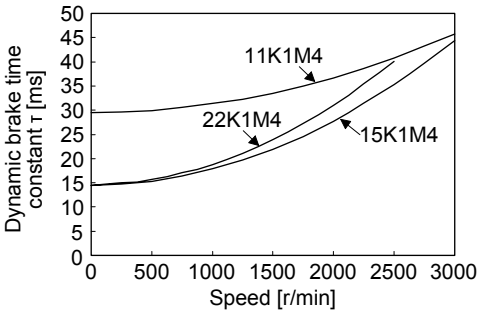


HG-UR series

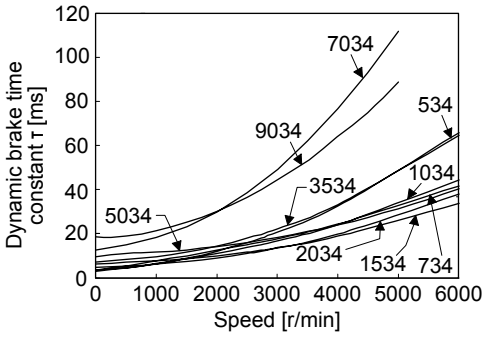
(b) 400 V class



HG-SR series



HG-JR1500 r/min series



HG-JR3000 r/min series

10.3.2 Permissible load to motor inertia when the dynamic brake is used

Use the dynamic brake under the load to motor inertia ratio indicated in the following table. If the ratio is higher than this value, the dynamic brake may burn. If there is a possibility that the ratio may exceed the value, contact your local sales office.
The values of the permissible load to motor inertia ratio in the table are the values at the maximum rotation speed of the servo motor. The value in the parenthesis shows the value at the rated speed.

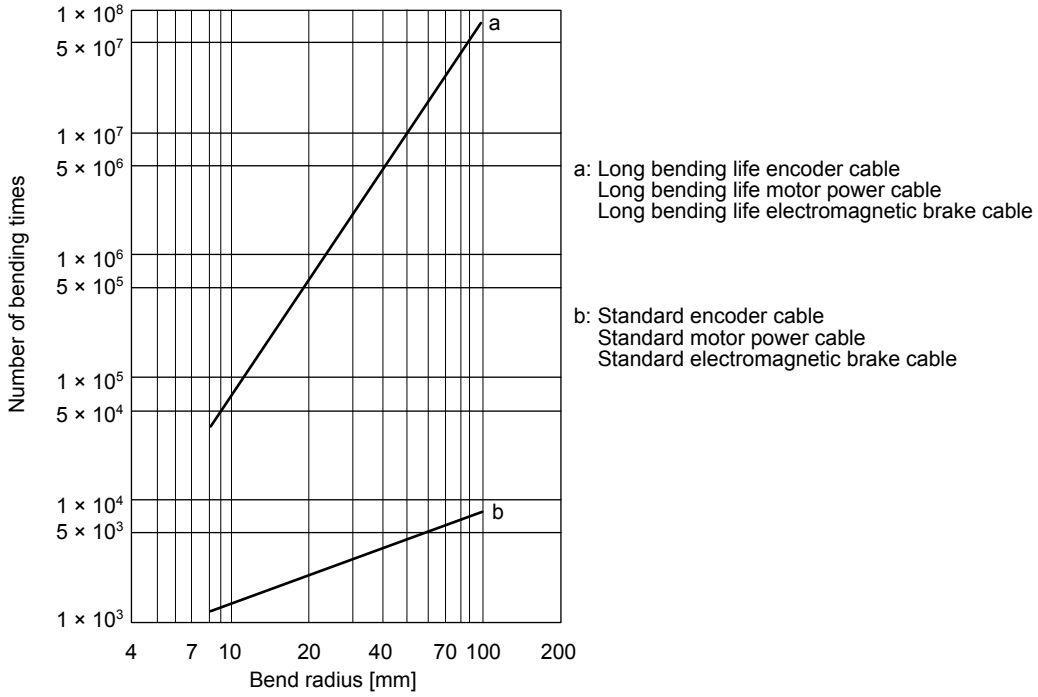
Servo motor	Permissible load to motor inertia ratio [multiplier]
HG-KR053	30
HG-KR13	
HG-KR23	
HG-KR43	
HG-KR73	
HG-MR053	35
HG-MR13	32
HG-MR23	
HG-MR43	
HG-MR73	
HG-SR51	30
HG-SR81	
HG-SR121	
HG-SR201	
HG-SR301	16
HG-SR421	15
HG-SR52	30
HG-SR102	
HG-SR152	21
HG-SR202	
HG-SR352	13 (15)
HG-SR502	
HG-SR702	5 (15)
HG-SR524	5 (15)
HG-SR1024	5 (17)
HG-SR1524	
HG-SR2024	5 (15)
HG-SR3524	
HG-SR5024	
HG-SR7024	
HG-UR72	30
HG-UR152	

Servo motor	Permissible load to motor inertia ratio [multiplier]
HG-UR202	16
HG-UR352	
HG-UR502	15
HG-RR103	30
HG-RR153	
HG-RR203	16
HG-RR353	15
HG-RR503	
HG-JR53	30
HG-JR73	
HG-JR103	
HG-JR203	
HG-JR353	16 (30)
HG-JR503	15 (30)
HG-JR703	11 (30)
HG-JR903	18 (30)
HG-JR11K1M	10 (30)
HG-JR15K1M	
HG-JR22K1M	20 (30)
HG-JR534	30 (30)
HG-JR734	
HG-JR1034	
HG-JR1534	
HG-JR2034	
HG-JR3534	20 (30) (Note)
HG-JR5034	15 (30)
HG-JR7034	11 (30)
HG-JR9034	18 (30)
HG-JR11K1M4	10 (30)
HG-JR15K1M4	
HG-JR22K1M4	20 (30)

Note. When the maximum torque is increased to 400%, the permissible load to motor inertia ratio at the maximum speed of the servo motor is 25 times.

10.4 Cable bending life

The bending life of the cables is shown below. This graph calculated values. Since they are not guaranteed values, provide a little allowance for these values.



10.5 Inrush currents at power-on of main circuit and control circuit

POINT
●The inrush current values can change depending on frequency of turning on/off the power and ambient temperature.

Since large inrush currents flow in the power supplies, always use molded-case circuit breakers and magnetic contactors. (Refer to section 11.10.)
When circuit protectors are used, it is recommended that the inertia delay type, which is not tripped by an inrush current, be used.

(1) 200 V class

The following table indicates the inrush current (reference data) that will flow when 240 V AC is applied to the servo amplifier with the power supply capacity of 2500 kVA and the wiring length of 1 m. Even when you use a 1-phase 200 V AC power supply with MR-J4-10B-RJ020 to MR-J4-70B-RJ020, the inrush current of the main circuit power supply will be the same.

Servo amplifier	Inrush current (A_{0-P})	
	Main circuit power supply (L1, L2, and L3)	Control circuit power supply (L11 and L21)
MR-J4-10B-RJ020 MR-J4-20B-RJ020 MR-J4-40B-RJ020 MR-J4-60B-RJ020	30 A (attenuated to approx. 3 A in 20 ms)	20 A to 30 A (attenuated to approx. 1 A in 20 ms)
MR-J4-70B-RJ020 MR-J4-100B-RJ020	34 A (attenuated to approx. 7 A in 20 ms)	
MR-J4-200B-RJ020 MR-J4-350B-RJ020	113 A (attenuated to approx. 12 A in 20 ms)	
MR-J4-500B-RJ020	42 A (attenuated to approx. 20 A in 20 ms)	34 A (attenuated to approx. 2 A in 20 ms)
MR-J4-700B-RJ020	85 A (attenuated to approx. 20 A in 30 ms)	
MR-J4-11KB-RJ020	226 A (attenuated to approx. 30 A in 30 ms)	42 A (attenuated to approx. 2 A in 30 ms)
MR-J4-15KB-RJ020	226 A (attenuated to approx. 50 A in 30 ms)	
MR-J4-22KB-RJ020	226 A (attenuated to approx. 70 A in 30 ms)	

(2) 400 V class

The following table indicates the inrush current (reference data) that will flow when 480 V AC is applied to the servo amplifier with the power supply capacity of 2500 kVA and the wiring length of 1 m.

Servo amplifier	Inrush current (A_{0-P})	
	Main circuit power supply (L1, L2, and L3)	Control circuit power supply (L11 and L21)
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020	65 A (attenuated to approx. 5 A in 10 ms)	40 A to 50 A (attenuated to approx. 0 A in 2 ms)
MR-J4-200B4-RJ020	80 A (attenuated to approx. 5 A in 10 ms)	
MR-J4-350B4-RJ020	100 A (attenuated to approx. 20 A in 10 ms)	
MR-J4-500B4-RJ020	65 A (attenuated to approx. 9 A in 20 ms)	41 A (attenuated to approx. 0 A in 3 ms)
MR-J4-700B4-RJ020	68 A (attenuated to approx. 34 A in 20 ms)	
MR-J4-11KB4-RJ020	339 A (attenuated to approx. 10 A in 30 ms)	38 A (attenuated to approx. 1 A in 30 ms)
MR-J4-15KB4-RJ020	339 A (attenuated to approx. 15 A in 30 ms)	
MR-J4-22KB4-RJ020	339 A (attenuated to approx. 20 A in 30 ms)	

(3) 100 V class

The following table indicates the inrush currents (reference data) that will flow when 120 V AC is applied at the power supply capacity of 2500 kVA and the wiring length of 1 m.

Servo amplifier	Inrush currents (A_{0-P})	
	Main circuit power supply (L1 and L2)	Control circuit power supply (L11 and L21)
MR-J4-10B1-RJ020 MR-J4-20B1-RJ020 MR-J4-40B1-RJ020	38 A (attenuated to approx. 14 A in 10 ms)	20 A to 30 A (attenuated to approx. 0 A in 1 ms to 2 ms)

MEMO

11. OPTIONS AND PERIPHERAL EQUIPMENT

⚠WARNING	●Before connecting any option or peripheral equipment, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P+ and N- is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION	●Use the specified peripheral equipment and options to prevent a malfunction or a fire.

POINT

●We recommend using HIV wires to wire the servo amplifiers, options, and peripheral equipment. Therefore, the recommended wire sizes may differ from those used for the previous servo amplifiers.

11.1 Cable/connector sets

POINT

●The IP rating indicated for cables and connectors is their protection against ingress of dust and raindrops when they are connected to a servo amplifier or servo motor. If the IP rating of the cable, connector, servo amplifier and servo motor vary, the overall IP rating depends on the lowest IP rating of all components.

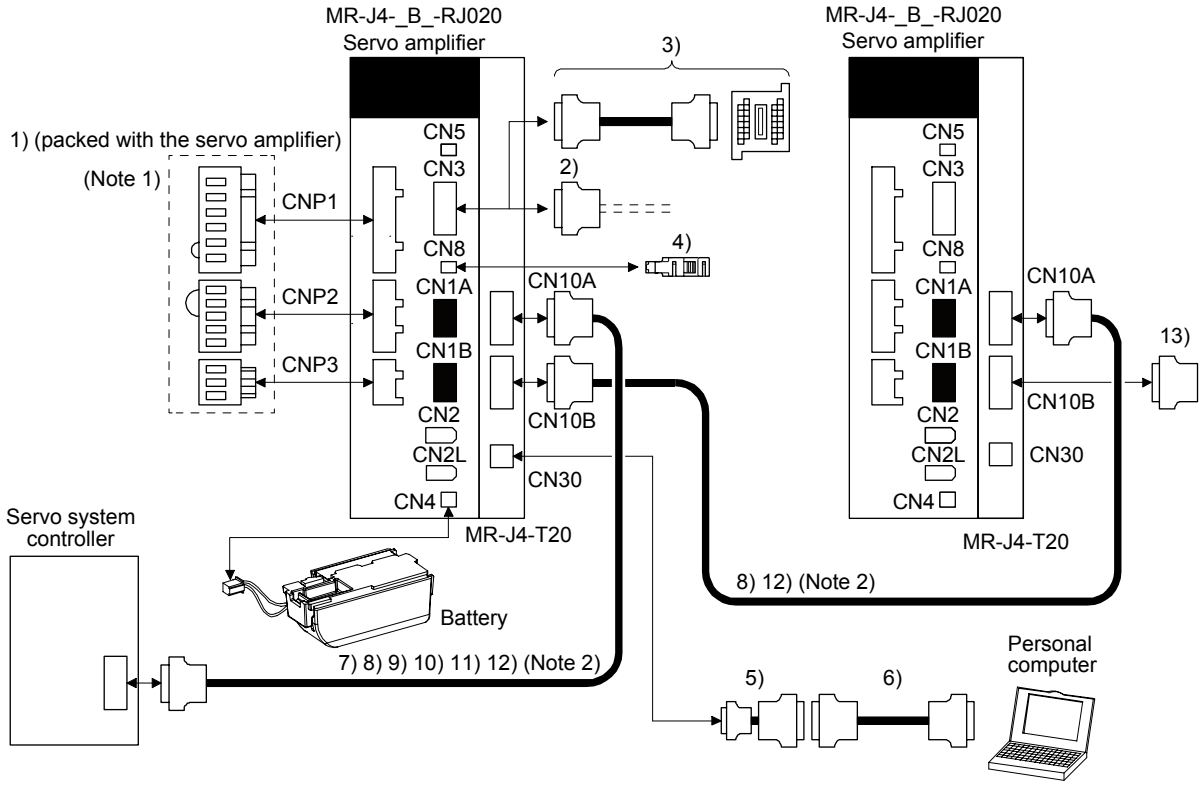
●The CN1A and CN1B connectors are not used in the J2S compatibility mode. Always put caps came with the servo amplifier.

●The CN8 connector is not used in the J2S compatibility mode. Always attach the short-circuit connector came with the servo amplifier.

●For connecting the servo amplifier with the HG series servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".

Please purchase the cable and connector options indicated in this section.

11.1.1 Combinations of cable/connector sets



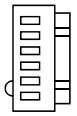
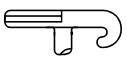
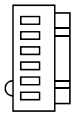
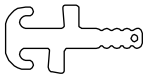
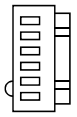
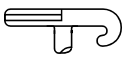
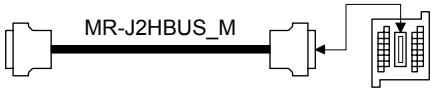
Note 1. Connectors for 3.5 kW or less. For 5 kW or more, it is a terminal block.

2. The SSCNET cables vary depending on servo system controllers connected. Refer to the following table for selecting SSCNET cables.

Servo system controller		Servo amplifier
		MR-J4-_B_-RJ020 + MR-J4-T20 MR-J2S-_B_ MR-J2-03B5
Positioning module	QD75M	8) MR-J2HBUS_M 12) MR-J2CN1
	A1SD75M	7) MR-J2HBUS_M-A 11) MR-J2CN1-A
Motion controller	Q172CPU(N)	9) Q172J2BCBL_M(-B)
	Q173CPU(N)	10) Q173J2B_CBL_M
	A171SHCPU(N) A172SHCPU(N) A173UHCPU	7) MR-J2HBUS_M-A 11) MR-J2CN1-A

Additionally, select a SSCNET cable from the followings to connect previous and next axis servo amplifiers.

Previous axis servo amplifier	Next servo amplifier
	MR-J4-_B_-RJ020 + MR-J4-T20 MR-J2S-_B_ MR-J2-03B5
MR-J4-_B_-RJ020 + MR-J4-T20 MR-J2S-_B_ MR-J2-03B5	8) MR-J2HBUS_M 12) MR-J2CN1

No.	Product name	Model	Description	Application
1)	Servo amplifier power connector set		 CNP1 connector: 06JFAT-SAXGDK-H7.5 (JST) CNP2 connector: 05JFAT-SAXGDK-H5.0 (JST) CNP3 connector: 03JFAT-SAXGDK-H7.5 (JST) Applicable wire size: 0.8 mm^2 to 2.1 mm^2 (AWG 18 to 14) Insulator OD: to 3.9 mm  Open tool J-FAT-OT (JST)	Supplied with 200 V class and 100 V class servo amplifiers of 1 kW or less
			 CNP1 connector: 06JFAT-SAXGFK-XL (JST) (CNP1 and CNP3) Applicable wire size: 1.25 mm^2 to 5.5 mm^2 (AWG 16 to 10) Insulator OD: to 4.7 mm CNP2 connector: 05JFAT-SAXGDK-H5.0 (JST) (CNP2) Applicable wire size: 0.8 mm^2 to 2.1 mm^2 (AWG 18 to 14) Insulator OD: to 3.9 mm CNP3 connector: 03JFAT-SAXGFK-XL (JST)  Open tool Quantity: 1 Model: J-FAT-OT-EXL (JST)	Supplied with 200 V class servo amplifiers of 2 kW and 3.5 kW
			 CNP1 connector: 06JFAT-SAXGDK-HT10.5 (JST) CNP2 connector: 05JFAT-SAXGDK-HT7.5 (JST) CNP3 connector: 03JFAT-SAXGDK-HT10.5 (JST) Applicable wire size: 1.25 mm^2 to 2.1 mm^2 (AWG 16 to 14) Insulator OD: to 3.9 mm  Open tool J-FAT-OT-XL (JST)	Supplied with 400 V class servo amplifiers of 3.5 kW or less
2)	Connector set	MR-CCN1	 Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)	
3)	Junction terminal block (recommended)		PS7DW-20V14B-F (Yoshida Electric Industry)  MR-J2HBUS_M The junction terminal block PS7DW-20V14B-F is not provided as an option. For using the junction terminal block, the optional MR-J2HBUS_M is necessary. Refer to section 11.6 for details.	
4)	Short-circuit connector			Supplied with servo amplifiers

No.	Product name	Model	Description	Application
5)	Junction cable for RS-232C	MR-J4T20CH00	Connector: HDR-E14MG1+ Receptacle: 10220-0200EL Case: HDR-E14LPA5 Shell kit: 10320-E2W0-008 (Honda Tsushin Kogyo) (3M) Refer to section 11.1.3 for details.	For junction with a PC-AT compatible personal computer
6)	Personal computer communication cable (RS-232C cable)	MR-CPCATCBL3M	Connector: 10120-6000EL Connector: DE-9SF-N Shell kit: 10320-3210-000 Connector case: DE-C1-J6-S6 (3M or equivalent) (JAE) Refer to section 11.1.3 for details.	For connection with a PC-AT compatible personal computer
7)	SSCNET cable	MR-J2HBUS_M-A	Connector: PCR-S20FS+ Connector: 10120-6000EL Case: PCR-LS20LA1 Shell kit: 10320-3210-000 (Honda Tsushin Kogyo) (3M or equivalent) Refer to section 11.1.2 (1) for details.	
8)	SSCNET cable	MR-J2HBUS_M	Connector: 10120-6000EL Connector: 10120-6000EL Shell kit: 10320-3210-000 Shell kit: 10320-3210-000 (3M or equivalent) (3M or equivalent) Refer to section 11.1.2 (2) for details.	
9)	SSCNET cable	Q172J2BCBL_M (-B)	Connector: HDR-E14MG1+ Connector: 10120-6000EL Case: HDR-E14LPA5 Shell kit: 10320-3210-000 (Honda Tsushin Kogyo) (3M or equivalent) (Note) Socket: HNC2-2.5S-2 Terminal: HNC2-2.5S-D-B (Hirose Electric) Note. For the battery unit Q170BAT, use Q172J2BCBL_M-B. Refer to section 11.1.2 (3) for details.	
10)	SSCNET cable	Q173J2B_CBL_M	Connector: HDR-E26MG1+ Connector: 10120-6000EL Case: HDR-E26LPA5 Shell kit: 10320-3210-000 (Honda Tsushin Kogyo) (3M or equivalent) Refer to section 11.1.2 (4) for details.	
11)	Connector set	MR-J2CN1-A	Connector: PCR-S20FS+ Connector: 10120-3000PE Case: PCR-LS20LA1 Shell kit: 10320-52F0-008 (Honda Tsushin Kogyo) (3M or equivalent) Refer to section 11.1.2 (1) for details.	
12)	Connector set	MR-J2CN1	Connector: 10120-3000PE Shell kit: 10320-52F0-008 Quantity: 2 each (3M or equivalent) Refer to section 11.1.2 (2) for details.	
13)	Terminal connector	MR-A-TM		

11.1.2 SSCNET cable

> **⚠CAUTION** ●If you have fabricated the SSCNET cable, connect it correctly. Otherwise, it may cause an unexpected operation and malfunction.

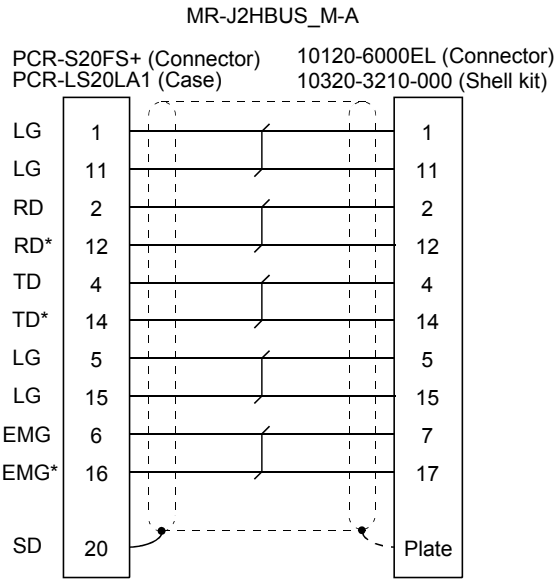
(1) MR-J2HBUS_M-A

(a) Model explanations

Model: MR－J2HBUS05M－A

Symbol	Cable length [m]
05	0.5
1	1
5	5

(b) Cable internal wiring diagram



(c) SSCNET cable fabrication

Use the MR-J2CN1-A connector set to fabricate the cable according to the wiring diagram in (b). The overall cable length in the same SSCNET system should be within 30 m. Refer to section 11.9 for the specifications of the cable to use.

(2) MR-J2HBUS_M

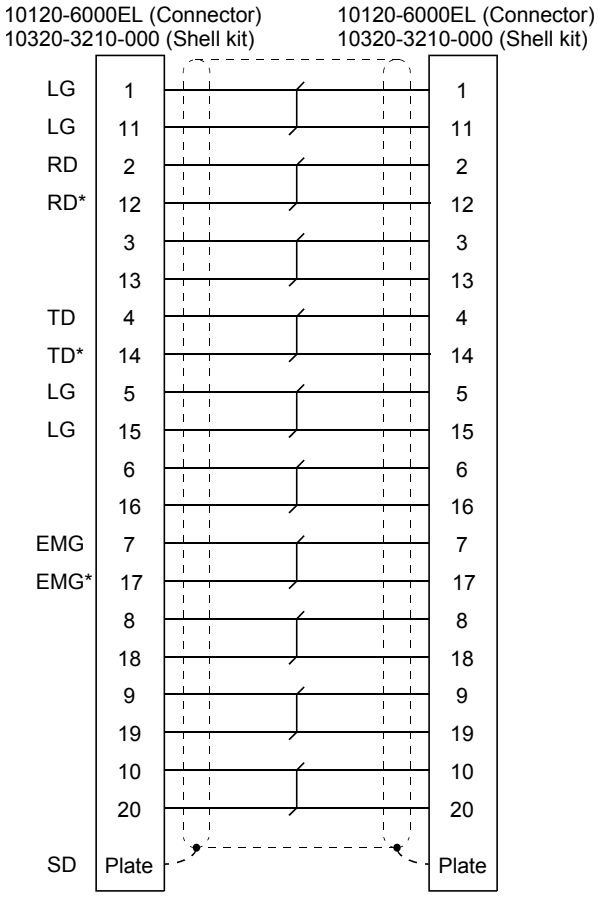
(a) Model explanations

Model: MR－J2HBUS05M

Symbol	Cable length [m]
05	0.5
1	1
5	5

(b) Cable internal wiring diagram

MR-J2HBUS_M



(c) SSCNET cable fabrication

Use the MR-J2CN1 connector set to fabricate the cable according to the wiring diagram in (b). The overall cable length in the same SSCNET system should be within 30 m. Refer to section 11.9 for the specifications of the cable to use.

(3) Q172J2BCBL_M(-B)

For the battery unit Q170BAT, use Q172J2BCBL_M-B. For Q170BAT, refer to the "motion controller Q series user's manual" of (IB(NA)0300040).

(a) Model explanations

Model: Q 1 7 2 J 2 B C B L 0 5 M − B

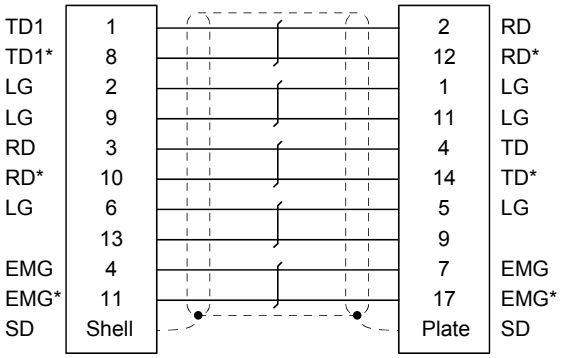
Symbol	Connection of battery unit
None	None
-B	Yes

Symbol	Cable length [m]
05	0.5
1	1
5	5

(b) Cable internal wiring diagram

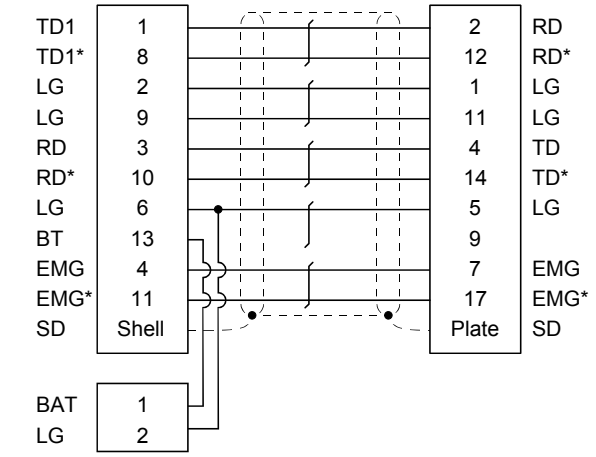
Q172J2BCBL_M

HDR-E14MG1+ (Connector) 10120-6000EL (Connector)
HDR-E14-LPA5 (Case) 10320-3210-000 (Shell kit)



Q172J2BCBL_M-B

HDR-E14MG1+ (Connector) 10120-6000EL (Connector)
HDR-E14-LPA5 (Case) 10320-3210-000 (Shell kit)



HNC2-2.5S-2 (Socket)
HNC2-2.5S-D-B (Terminal)

(4) Q173J2B_CBL_M

(a) Model explanations

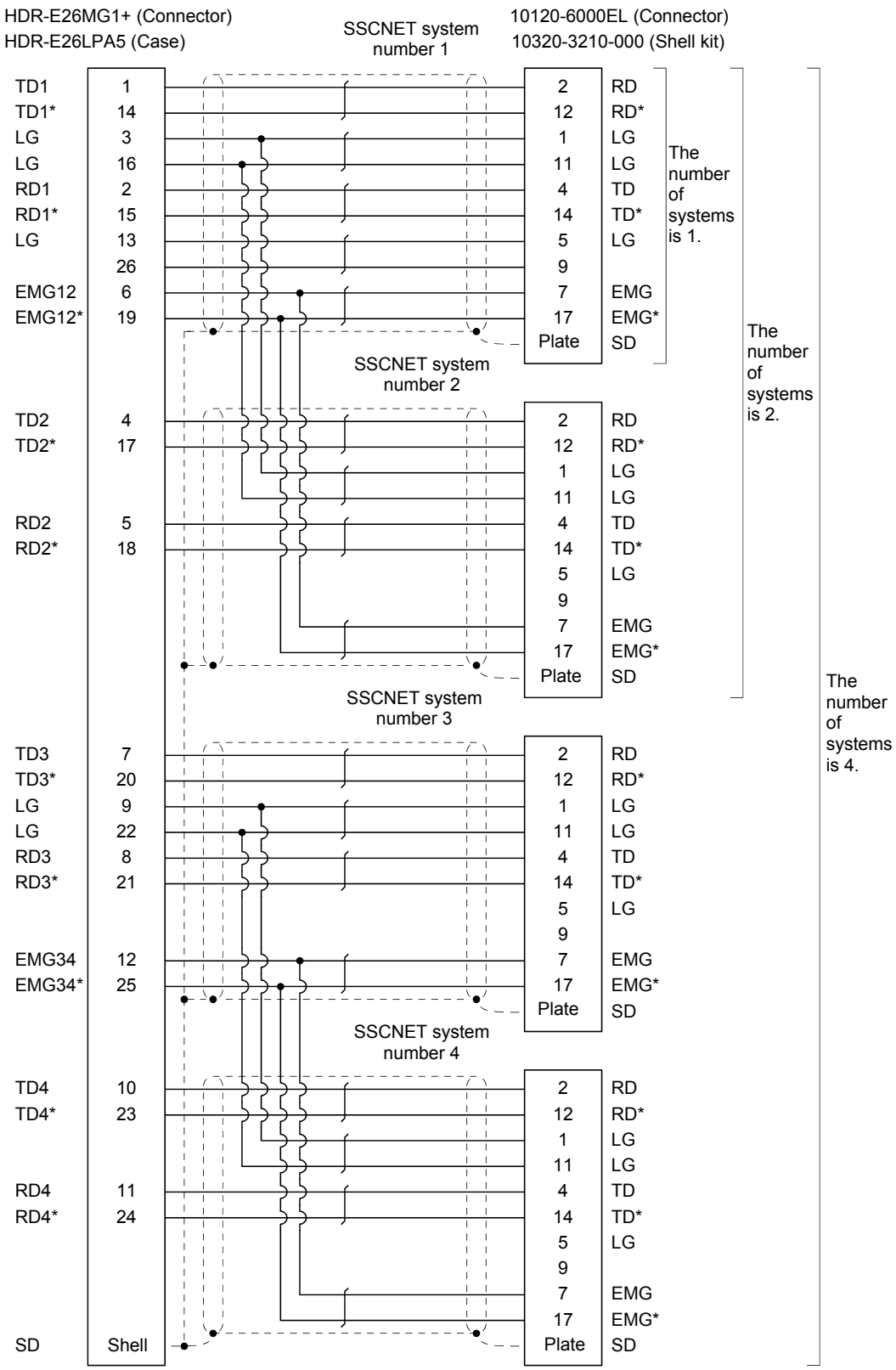
Model: Q 1 7 3 J 2 B 2 C B L 0 5 M

Symbol	Cable length [m]
05	0.5
1	1
5	5

Symbol	The number of SSCNET system
None	1
2	2
4	4

(b) Cable internal wiring diagram

Q173J2B_CBL_M

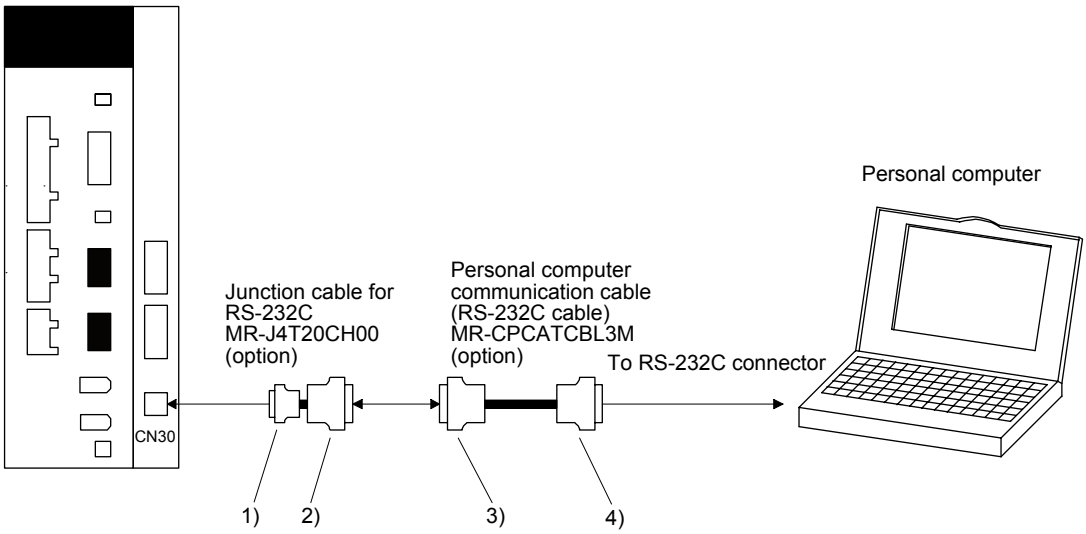


11.1.3 RS-232C communication cable

This section indicates the cable which connects MR-J4-T20 to a personal computer via RS-232C communication. The RS-232C communication cable consists of the following two cables.

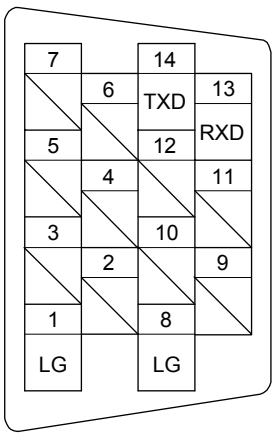
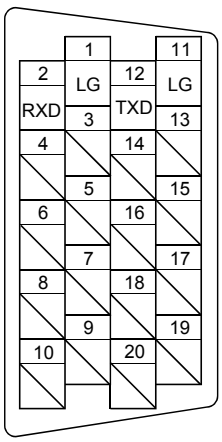
Cable model	Cable length	Product name
MR-J4T20CH00	0.2 m	Junction cable for RS-232C
MR-CPCATCBL3M	3 m	Personal computer communication cable (RS-232C cable)

(1) Connection of MR-J4-T20 with a personal computer

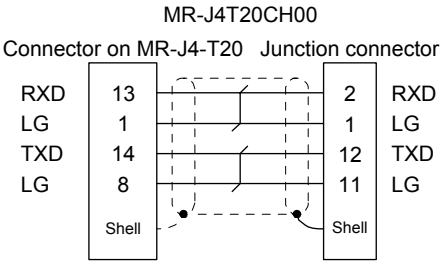


(2) MR-J4T20CH00

(a) Cable specifications

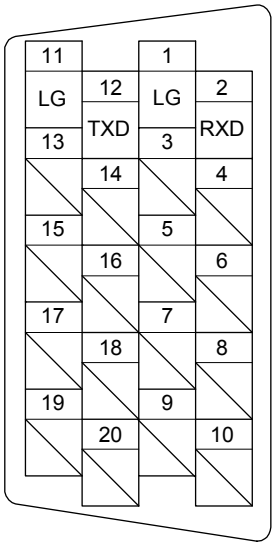
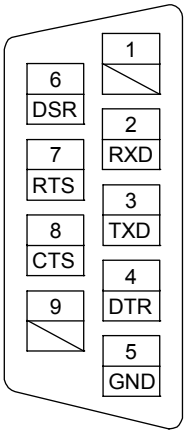
Cable model	1) MR-J4-T20 connector	2) Junction connector
MR-J4T20CH00	Connector: HDR-E14MG1+ Connector case: HDR-E14LPA5 (Honda Tsushin Kogyo)  View seen from the wiring side. (Note) Note. Keep open the pins shown with ⊘.	Connector: 10220-0200EL Shell kit: 10320-E2W0-008 (3M)  View seen from the wiring side. (Note) Note. Keep open the pins shown with ⊘.

(b) Cable internal wiring diagram

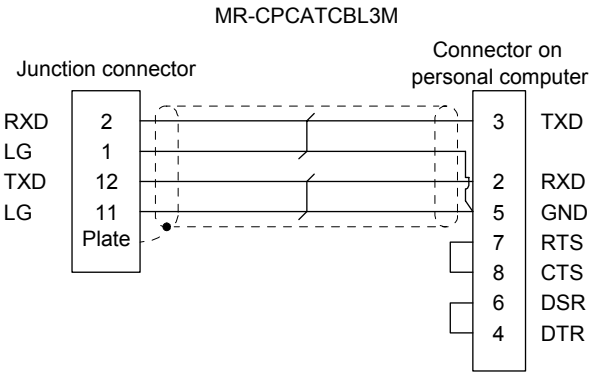


(3) MR-CPCATCBL3M

(a) Cable specifications

Cable model	3) Junction connector	4) Personal computer side connector
MR-CPCATCBL3M	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent)  View seen from the wiring side. (Note) Note. Keep open the pins shown with ⊘.	Connector: DE-9SF-N Case: DE-C1-J6-S6 (JAE)  View seen from the wiring side. (Note) Note. Keep open the pins shown with ⊘.

(b) Cable internal wiring diagram



11.2 Regenerative option

⚠CAUTION ●Do not use servo amplifiers with regenerative options other than the combinations specified below. Otherwise, it may cause a fire.

11.2.1 Combination and regenerative power

The power values in the table are resistor-generated powers and not rated powers.

(1) 200 V class

Servo amplifier	Regenerative power [W]									
	Built-in regenera-tive resistor	MR-RB032 [40 Ω]	MR-RB12 [40 Ω]	MR-RB30 [13 Ω]	MR-RB3N [9 Ω]	MR-RB31 [6.7 Ω]	MR-RB32 [40 Ω]	(Note 1) MR-RB50 [13 Ω]	(Note 1) MR-RB5N [9 Ω]	(Note 1) MR-RB51 [6.7 Ω]
MR-J4-10B-RJ020		30								
MR-J4-20B-RJ020	10	30	100							
MR-J4-40B-RJ020	10	30	100							
MR-J4-60B-RJ020	10	30	100							
MR-J4-70B-RJ020	20	30	100				300			
MR-J4-100B-RJ020	20	30	100				300			
MR-J4-200B-RJ020	100			300				500		
MR-J4-350B-RJ020	100				300				500	
MR-J4-500B-RJ020	130					300				500
MR-J4-700B-RJ020	170					300				500

Servo amplifier	(Note 2) Regenerative power [W]			
	External regenerative resistor (accessory)	MR-RB5R [3.2 Ω]	MR-RB9F [3 Ω]	MR-RB9T [2.5 Ω]
MR-J4-11KB-RJ020	500 (800)	500 (800)		
MR-J4-15KB-RJ020	850 (1300)		850 (1300)	
MR-J4-22KB-RJ020	850 (1300)			850 (1300)

Note 1. Always install a cooling fan.
2. Values in parentheses assume the installation of a cooling fan.

(2) 400 V class

Servo amplifier	Regenerative power [W]								
	Built-in regenera -tive resistor	MR-RB1H-4 [82 Ω]	(Note 1) MR-RB3M-4 [120 Ω]	(Note 1) MR-RB3G-4 [47 Ω]	(Note 1) MR-RB5G-4 [47 Ω]	(Note 1) MR-RB34-4 [26 Ω]	(Note 1) MR-RB54-4 [26 Ω]	(Note 1) MR-RB3U-4 [22 Ω]	(Note 1) MR-RB5U-4 [22 Ω]
MR-J4-60B4-RJ020	15	100	300						
MR-J4-100B4-RJ020	15	100	300						
MR-J4-200B4-RJ020	100			300	500				
MR-J4-350B4-RJ020	100			300	500				
MR-J4-500B4-RJ020	130					300	500		
MR-J4-700B4-RJ020	170							300	500

Servo amplifier	(Note 2) Regenerative power [W]		
	External regenerative resistor (accessory)	MR-RB5K-4 [10 Ω]	MR-RB6K-4 [10 Ω]
MR-J4-11KB4-RJ020	500 (800)	500 (800)	
MR-J4-15KB4-RJ020	850 (1300)		850 (1300)
MR-J4-22KB4-RJ020	850 (1300)		850 (1300)

Note 1. Always install a cooling fan.
2. Values in parentheses assume the installation of a cooling fan.

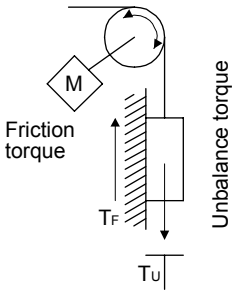
(3) 100 V class

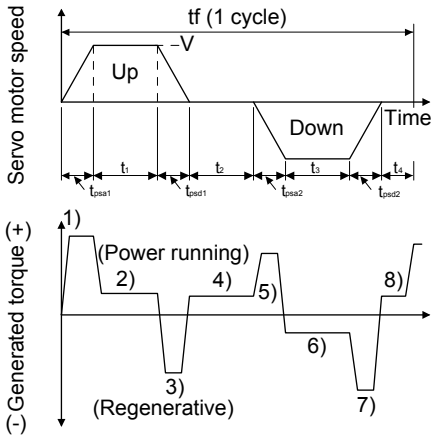
Servo amplifier	Regenerative power [W]		
	Built-in regenerative resistor	MR-RB032 [40 Ω]	MR-RB12 [40 Ω]
MR-J4-10B1-RJ020		30	
MR-J4-20B1-RJ020	10	30	100
MR-J4-40B1-RJ020	10	30	100

11.2.2 Selection of the regenerative option

Use the following method when regeneration occurs continuously in vertical motion applications or when it is desired to make an in-depth selection of the regenerative option.

(1) Regenerative energy calculation





Formulas for calculating torque and energy in operation

Regenerative power	Torque applied to servo motor [N•m]	Energy E [J]
1)	$T_1 = \frac{(J_L/\eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa1}} + T_U + T_F$	$E_1 = \frac{0.1047}{2} \cdot V \cdot T_1 \cdot t_{psa1}$
2)	$T_2 = T_U + T_F$	$E_2 = 0.1047 \cdot V \cdot T_2 \cdot t_1$
3)	$T_3 = \frac{-(J_L \cdot \eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psa2}} + T_U + T_F$	$E_3 = \frac{0.1047}{2} \cdot V \cdot T_3 \cdot t_{psa2}$
4), 8)	$T_4, T_8 = T_U$	$E_4, E_8 \geq 0$ (No regeneration)
5)	$T_5 = \frac{(J_L/\eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd2}} - T_U + T_F$	$E_5 = \frac{0.1047}{2} \cdot V \cdot T_5 \cdot t_{psd2}$
6)	$T_6 = -T_U + T_F$	$E_6 = 0.1047 \cdot V \cdot T_6 \cdot t_3$
7)	$T_7 = \frac{-(J_L \cdot \eta + J_M) \cdot V}{9.55 \cdot 10^4} \cdot \frac{1}{t_{psd2}} - T_U + T_F$	$E_7 = \frac{0.1047}{2} \cdot V \cdot T_7 \cdot t_{psd2}$

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

(2) Losses of the servo motor and servo amplifier in regenerative mode

The following table lists the efficiencies and other data of the servo motor and servo amplifier in the regenerative mode.

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-J4-10B-RJ020	55	9
MR-J4-20B-RJ020	75	9
MR-J4-40B-RJ020	85	11
MR-J4-60B-RJ020	85	11
MR-J4-70B-RJ020	85	18
MR-J4-100B-RJ020	85	18
MR-J4-200B-RJ020	85	36
MR-J4-350B-RJ020	85	40
MR-J4-500B-RJ020	90	45
MR-J4-700B-RJ020	90	70
MR-J4-11KB-RJ020	90	120
MR-J4-15KB-RJ020	90	170
MR-J4-22KB-RJ020	90	250

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-J4-60B4-RJ020	85	12
MR-J4-100B4-RJ020	85	12
MR-J4-200B4-RJ020	85	25
MR-J4-350B4-RJ020	85	43
MR-J4-500B4-RJ020	90	45
MR-J4-700B4-RJ020	90	70
MR-J4-11KB4-RJ020	90	120
MR-J4-15KB4-RJ020	90	170
MR-J4-22KB4-RJ020	90	250
MR-J4-10B1-RJ020	55	4
MR-J4-20B1-RJ020	75	4
MR-J4-40B1-RJ020	85	10

Inverse efficiency (η): Efficiency including some efficiencies of the servo motor and servo amplifier when the rated (regenerative) torque is generated at the rated speed. Since the efficiency varies with the speed and generated torque, allow for about 10%.

Capacitor charging (Ec): Energy charged into the electrolytic capacitor in the servo amplifier

Subtract the capacitor charging from the result of multiplying the sum total of regenerative energies by the inverse efficiency to calculate the energy consumed by the regenerative option.

$ER [J] = \eta \cdot Es - Ec$

Calculate the power consumption of the regenerative option on the basis of one-cycle operation period tf [s] to select the necessary regenerative option.

$PR [W] = ER/tf$

11.2.3 Parameter setting

Set [Pr.2] according to the option to be used.

[Pr. 2]

0	0		

00: Regenerative option is not used.
- For servo amplifier of 100 W, regenerative option is not used.
- For servo amplifier of 0.2 kW to 7 kW, built-in regenerative resistor is used.
- Supplied regenerative resistors or regenerative option is used with the servo amplifier of 11 kW to 22 kW.

01: FR-RC/FR-RC-H/FR-CV/FR-CV-H/FR-BU2/FR-BU2-H
05: MR-RB32
08: MR-RB30
09: MR-RB50 (Cooling fan is required.)
0B: MR-RB31
0C: MR-RB51 (Cooling fan is required.)
0E: When the supplied regenerative resistors are cooled by the cooling fan to increase the ability with the servo amplifier of 11 kW to 22 kW.
10: MR-RB032
11: MR-RB12
13: MR-RB5E
14: MR-RB5E (Cooling fan is required.)
17: MR-RB9F
18: MR-RB9F (Cooling fan is required.)
20: MR-RB3N
21: MR-RB5N (Cooling fan is required.)
23: MR-RB5R
24: MR-RB5R (Cooling fan is required.)
25: MR-RB9P
26: MR-RB9P (Cooling fan is required.)
27: MR-RB9T
28: MR-RB9T (Cooling fan is required.)
80: MR-RB3H-4 (Cooling fan is required.)
81: MR-RB5H-4 (Cooling fan is required.)
82: MR-RB3G-4 (Cooling fan is required.)
83: MR-RB5G-4 (Cooling fan is required.)
84: MR-RB34-4 (Cooling fan is required.)
85: MR-RB54-4 (Cooling fan is required.)
86: MR-RB1L-4
87: MR-RB3M-4 (Cooling fan is required.)
90: MR-RB1H-4
9C: MR-RB3U-4 (Cooling fan is required.)
9D: MR-RB5U-4 (Cooling fan is required.)

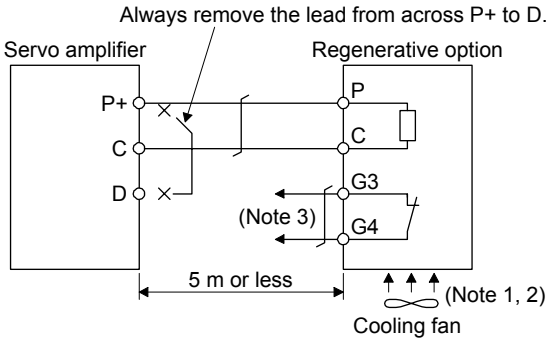
11.2.4 Selection of the regenerative option

POINT
●When MR-RB50, MR-RB51, MR-RB5N, MR-RB3M-4, MR-RB3G-4, MR-RB5G-4, MR-RB34-4, MR-RB54-4, MR-RB3U-4, or MR-RB5U-4 is used, a cooling fan is required to cool it. The cooling fan should be prepared by the customer. ●For the wire sizes used for wiring, refer to section 11.9.

The regenerative option generates heat of 100 ˚C higher than the ambient temperature. Fully consider heat dissipation, installation position, wires used, etc. before installing the option. For wiring, use flame-resistant wires or make the wires flame-resistant and keep them away from the regenerative option. Always use twisted cables of max. 5 m length for connection with the servo amplifier.

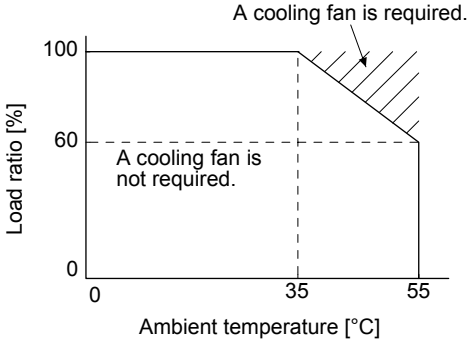
(1) MR-J4-500B-RJ020 or less/MR-J4-350B4-RJ020 or less

Always remove the wiring across P+ and D and fit the regenerative option between P+ and C. G3 and G4 are terminals for a thermal sensor. The connection between G3 and G4 is opened when the regenerative option overheats abnormally.



Note 1. When using the MR-RB50, MR-RB5N, MR-RB51, MR-RB3M-4, MR-RB3G-4, or MR-RB5G-4, forcedly cool it with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm).

2. When the ambient temperature is more than 55 °C and the regenerative load ratio is more than 60% in MR-RB30, MR-RB31, MR-RB32, and MR-RB3N, forcedly cool the air with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm). A cooling fan is not required if the ambient temperature is 35 °C or less. (A cooling fan is required for the shaded area in the following graph.)



3. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.

G3-G4 contact specifications

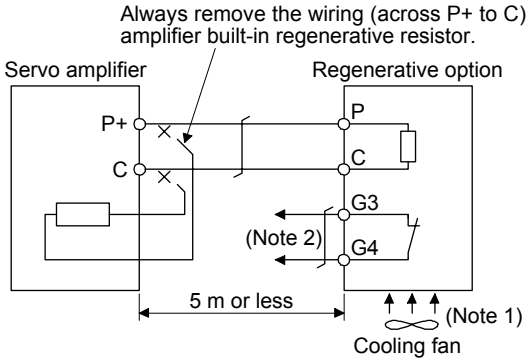
Maximum voltage: 120 V AC/DC

Maximum current: 0.5 A/4.8 V DC

Maximum capacity: 2.4 VA

(2) MR-J4-700B-RJ020/MR-J4-500B4-RJ020/MR-J4-700B4-RJ020

Always remove the wiring (between P+ and C) of the servo amplifier built-in regenerative resistor and fit the regenerative option between P+ and C. G3 and G4 are terminals for a thermal sensor. The connection between G3 and G4 is opened when the regenerative option overheats abnormally.



Note 1. When using the MR-RB51, MR-RB34-4, MR-RB54-4, MR-RB3U-4, or MR-RB5U-4, forcibly cool it with a cooling fan (1.0 m^3/min or more, 92 mm × 92 mm).

2. Make up a sequence which will switch off the magnetic contactor when abnormal heating occurs.

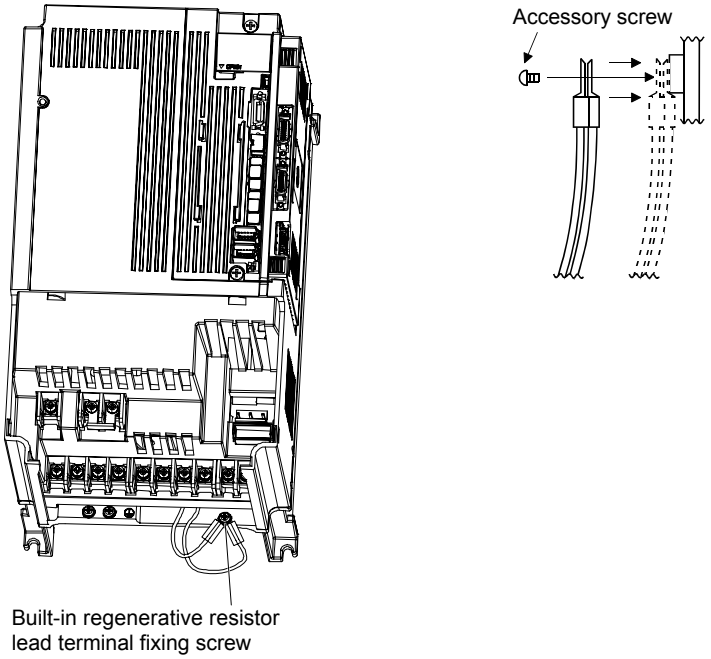
G3-G4 contact specifications

Maximum voltage: 120 V AC/DC

Maximum current: 0.5 A/4.8 V DC

Maximum capacity: 2.4 VA

When using the regenerative option, remove the servo amplifier's built-in regenerative resistor wires (across P+ to C), fit them back to back, and secure them to the frame with the accessory screw as shown below.



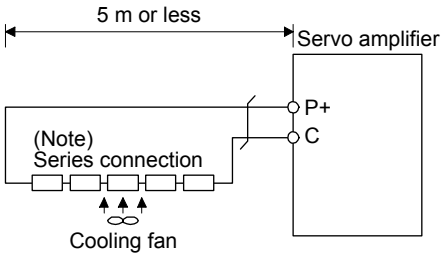
(3) MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to qMR-J4-22KB4-RJ020 (when using the supplied regenerative resistor)

⚠CAUTION

●Note the followings for supplied regenerative resistors of 11 kW to 22 kW servo amplifiers because they do not have protect covers.

- Touching the resistor will cause a burn because the surface of the parts is a resistive element and very high temperature.
- Even if the power turned off, touching the resistor will cause an electric shock because the capacitor of the servo amplifier is charged for a while.

When using the regenerative resistors supplied to the servo amplifier, the specified number of resistors (4 or 5 resistors) must be connected in series. If they are connected in parallel or in less than the specified number, the servo amplifier may become faulty and/or the regenerative resistors burn. Install the resistors at intervals of about 70 mm. Cooling the resistors with two cooling fans (92 × 92, minimum air flow: 1.0 m^3) improves the regeneration capability. In this case, set "_ _ 0 E" in [Pr. 2].



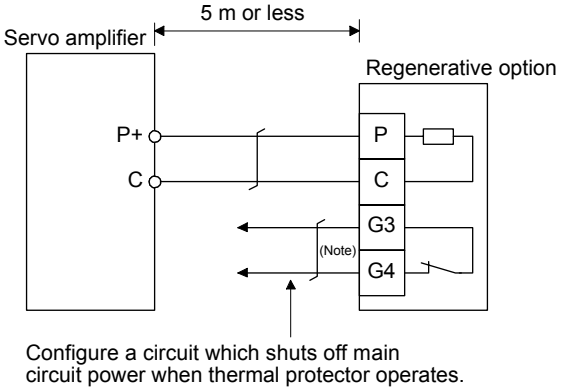
Note. The number of resistors connected in series depends on the resistor type. The thermal sensor is not mounted on the attached regenerative resistor. An abnormal heating of resistor may be generated at a regenerative circuit failure. Install a thermal sensor near the resistor and establish a protective circuit to shut off the main circuit power supply when abnormal heating occurs. The detection level of the thermal sensor varies according to the settings of the resistor. Set the thermal sensor in the most appropriate position on your design basis, or use the thermal sensor built-in regenerative option. (MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4, or MR-RB6K-4)

Servo amplifier	Regenerative resistor	Regenerative power [W]		Resultant resistance [Ω]	Number of resistors
		Normal	Cooling		
MR-J4-11KB-RJ020	GRZG400-0.8Ω	500	800	3.2	4
MR-J4-15KB-RJ020	GRZG400-0.6Ω	850	1300	3	5
MR-J4-22KB-RJ020	GRZG400-0.5Ω			2.5	
MR-J4-11KB4-RJ020	GRZG400-2.5Ω	500	800	10	4
MR-J4-15KB4-RJ020 MR-J4-22KB4-RJ020	GRZG400-2Ω	850	1300	10	5

(4) MR-J4-11KB-RZ020 to MR-J4-22KB-RZ020/MR-J4-11KB4-RZ020 to MR-J4-22KB4-RZ020 (when using the regenerative option)

MR-J4-11KB-RZ020 to MR-J4-22KB-RZ020/MR-J4-11KB4-RZ020 to MR-J4-22KB4-RZ020 are not supplied with regenerative resistors. When using any of these servo amplifiers, always use the MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4, or MR-RB6K-4.

Cooling the regenerative option with cooling fans improves regenerative capability. G3 and G4 are terminals for thermal sensor. Between G3 and G4 is opened when the regenerative option overheats abnormally.

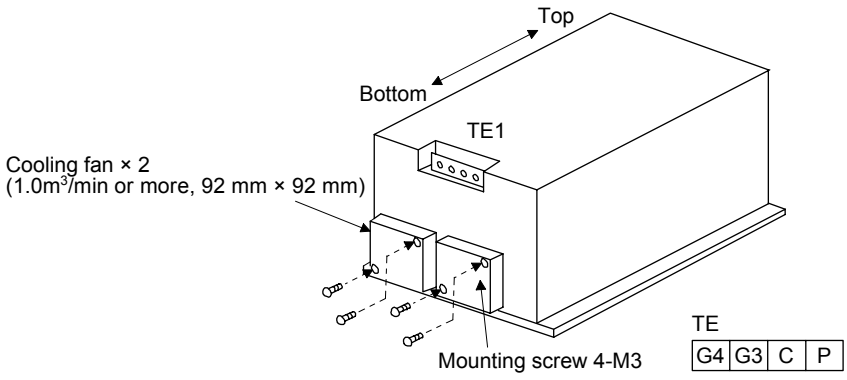


Note. G3-G4 contact specifications
Maximum voltage: 120 V AC/DC
Maximum current: 0.5 A/4.8 V DC
Maximum capacity: 2.4 VA

Servo amplifier	Regenerative option	Resistance [Ω]	Regenerative power [W]	
			Without cooling fans	With cooling fans
MR-J4-11KB-RZ020	MR-RB5R	3.2	500	800
MR-J4-15KB-RZ020	MR-RB9F	3	850	1300
MR-J4-22KB-RZ020	MR-RB9T	2.5	850	1300
MR-J4-11KB4-RZ020	MR-RB5K-4	10	500	800
MR-J4-15KB4-RZ020 MR-J4-22KB4-RZ020	MR-RB6K-4	10	850	1300

When using cooling fans, install them using the mounting holes provided in the bottom of the regenerative option.

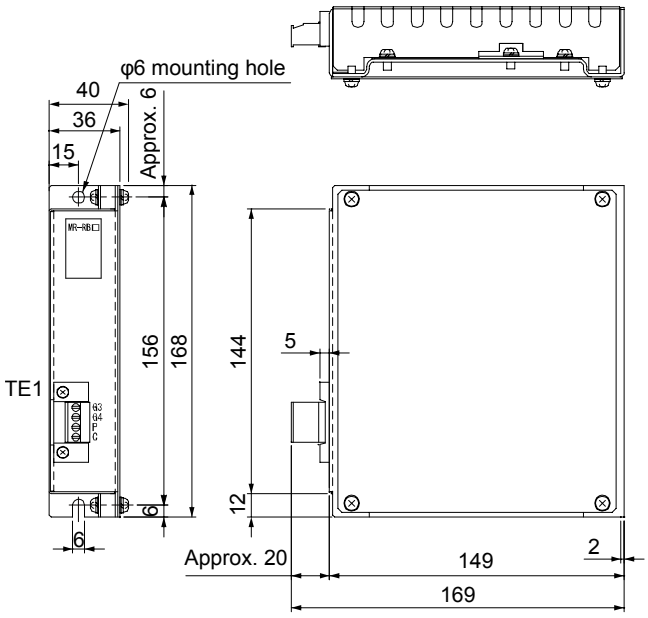
MR-RB5R/MR-RB9F/MR-RB9T/MR-RB5K-4/MR-RB6K-4



11.2.5 Dimensions

(1) MR-RB12

[Unit: mm]



- TE1 terminal block

G3
G4
P
C

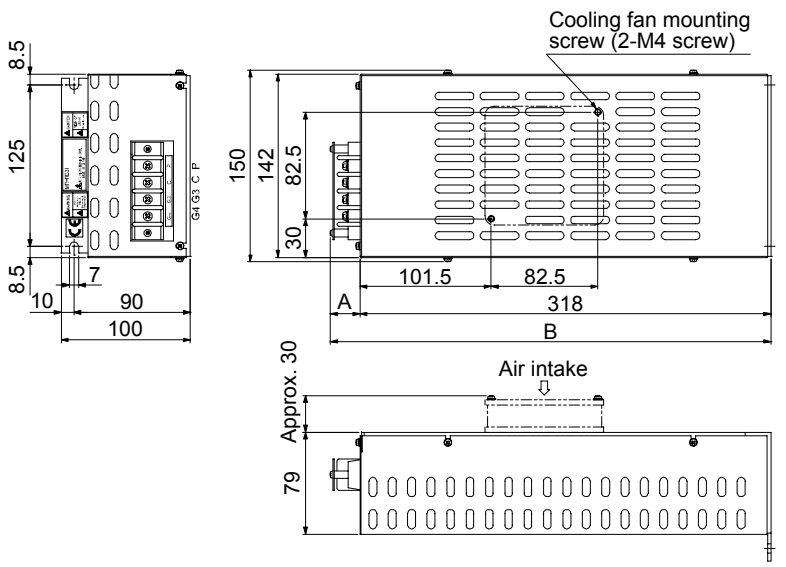
Applicable wire size: 0.2 mm^2 to 2.5 mm^2 (AWG 24 to 12)
Tightening torque: 0.5 to 0.6 [N•m]

- Mounting screw
  Screw size: M5
  Tightening torque: 3.24 [N•m]

Mass: 1.1 [kg]

(2) MR-RB30/MR-RB31/MR-RB32/MR-RB3N/MR-RB34-4/MR-RB3M-4/MR-RB3G-4/ MR-RB3U-4

[Unit: mm]



- Terminal block

P
C
G3
G4

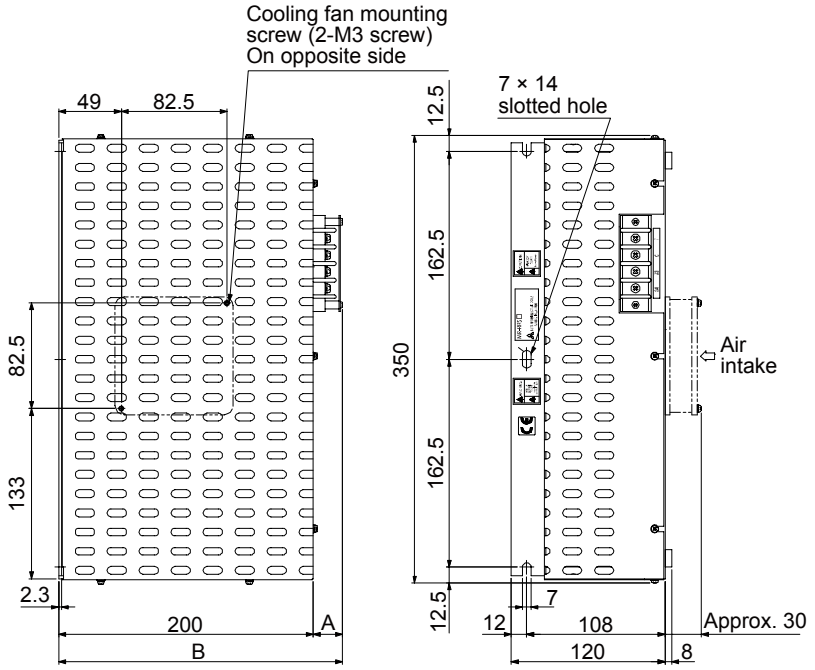
Terminal screw size: M4
Tightening torque: 1.2 [N•m]

- Mounting screw
  Screw size: M6
  Tightening torque: 5.4 [N•m]

Regenerative option	Variable dimensions		Mass [kg]
	A	B	
MR-RB30	17	335	2.9
MR-RB31			
MR-RB32			
MR-RB3N			
MR-RB34-4	23	341	
MR-RB3M-4			
MR-RB3G-4			
MR-RB3U-4			

(3) MR-RB50/MR-RB51/MR-RB5N/MR-RB54-4/MR-RB5G-4/MR-RB5U-4

[Unit: mm]



- Terminal block

P
C
G3
G4

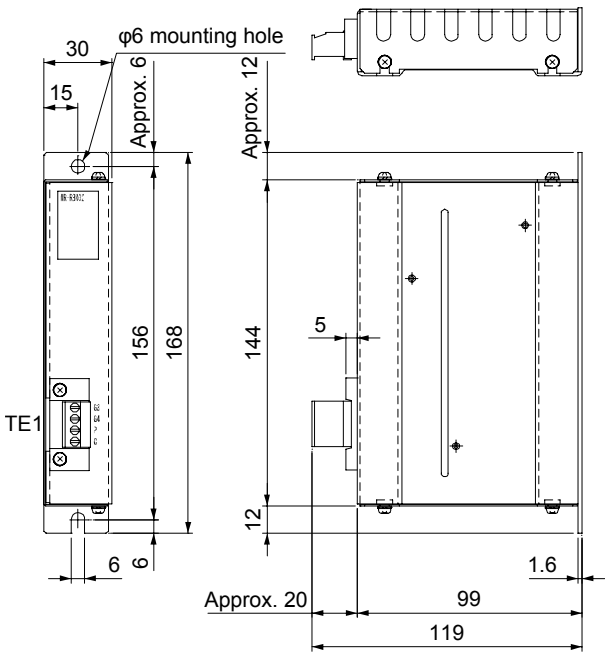
Terminal screw size: M4
Tightening torque: 1.2 [N•m]

- Mounting screw
  Screw size: M6
  Tightening torque: 5.4 [N•m]

Regenerative option	Variable dimensions		Mass [kg]
	A	B	
MR-RB50	17	217	5.6
MR-RB51			
MR-RB5N			
MR-RB54-4	23	223	
MR-RB5G-4			
MR-RB5U-4			

(4) MR-RB032

[Unit: mm]



- TE1 terminal block

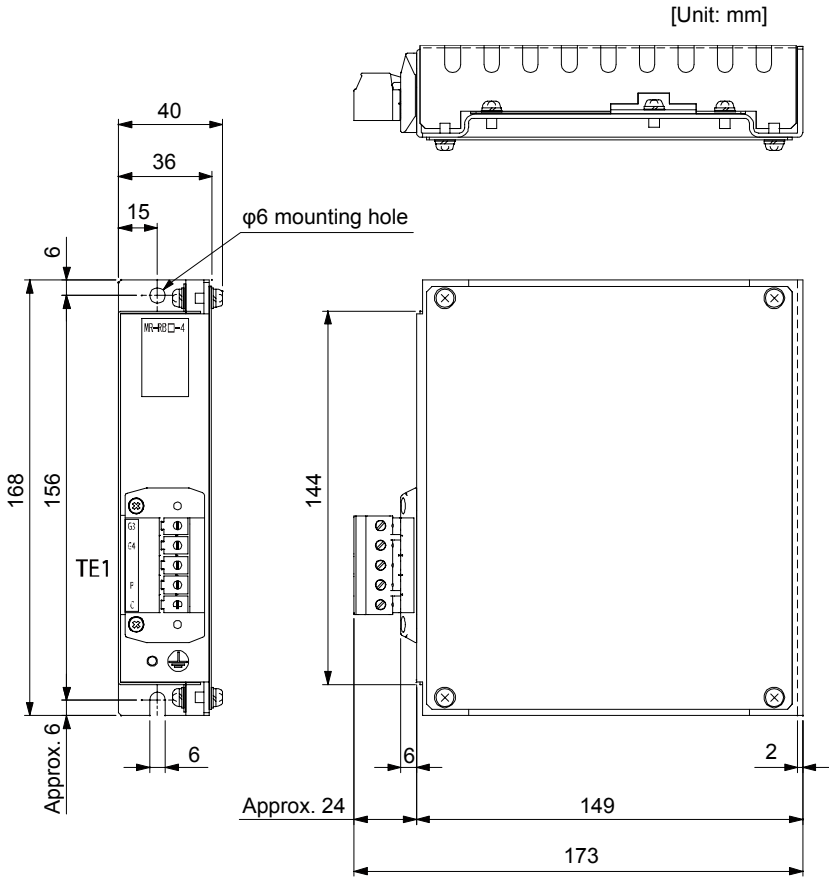
G3
G4
P
C

Applicable wire size: 0.2 mm^2 to 2.5mm^2
(AWG 24 to 12)
Tightening torque: 0.5 to 0.6 [N•m]

- Mounting screw
  Screw size: M5
  Tightening torque: 3.24 [N•m]

Mass: 0.5 [kg]

(5) MR-RB1H-4



- Terminal

G3
G4
P
C

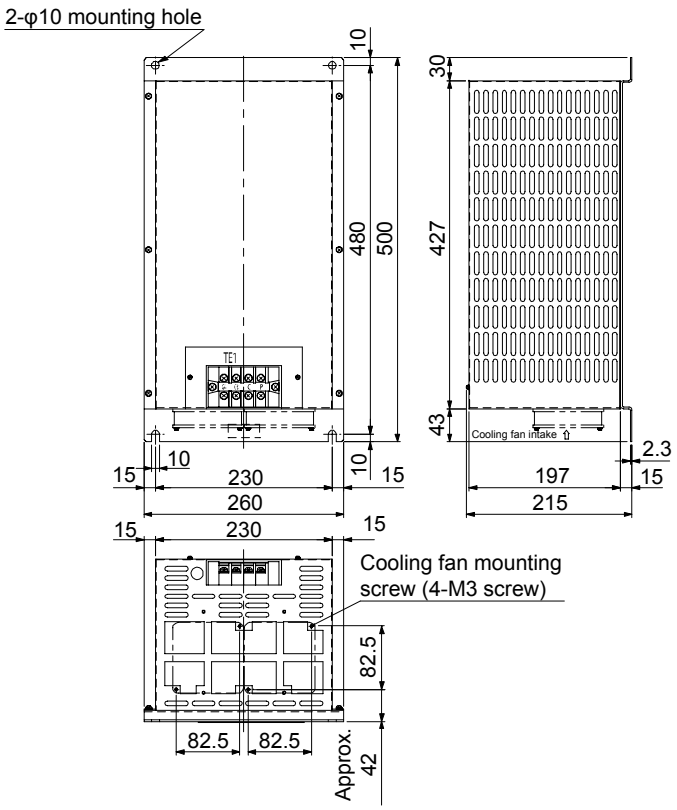
Applicable wire size: AWG 24 to 10
Tightening torque: 0.5 to 0.6 [N•m]

- Mounting screw
  Screw size: M5
  Tightening torque: 3.24 [N•m]

Mass: 1.1 [kg]

(6) MR-RB5R/MR-RB9F/MR-RB9T/MR-RB5K-4/MR-RB6K-4

[Unit: mm]



- Terminal block

G4	G3	C	P

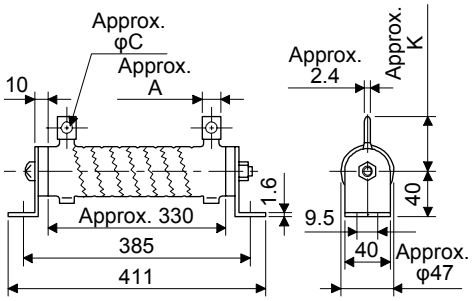
Terminal screw size: M5
Tightening torque: 2.0 [N•m]

- Mounting screw
Screw size: M8
Tightening torque: 13.2 [N•m]

Regenerative option	Mass [kg]
MR-RB5R	10
MR-RB9F	11
MR-RB9T	
MR-RB5K-4	10
MR-RB6K-4	11

(7) GRZG400-0.8Ω/GRZG400-0.6Ω/GRZG400-0.5Ω/GRZG400-2.5Ω/GRZG400-2.0Ω (standard accessories)

[Unit: mm]



Regenerative resistor	Variable dimensions			Mounting screw size	Tightening torque [N•m]	Mass [kg]
	A	C	K			
GRZG400-0.8Ω	10	5.5	39	M8	13.2	0.8
GRZG400-0.6Ω GRZG400-0.5Ω	16	8.2	46			
GRZG400-2.5Ω GRZG400-2.0Ω	10	5.5	39			

11.3 FR-BU2-(H) brake unit

POINT

- Use a 200 V class brake unit and a resistor unit with a 200 V class servo amplifier, and a 400 V class brake unit and a resistor unit with a 400 V class servo amplifier. Combination of different voltage class units cannot be used.
- When a brake unit and a resistor unit are installed horizontally or diagonally, the heat dissipation effect diminishes. Install them on a flat surface vertically.
- The temperature of the resistor unit case will be higher than the ambient temperature by 100 ˚C or over. Keep cables and flammable materials away from the case.
- The ambient temperature condition for the brake unit is between -10 ˚C and 50 ˚C. Note that the condition is different from the ambient temperature condition of the servo amplifier (between 0 ˚C and 55 ˚C).
- Configure the circuit to shut down the power-supply with the alarm output of the brake unit and the resistor unit under abnormal condition.
- Use the brake unit with a combination indicated in section 11.3.1.
- For executing a continuous regenerative operation, use the FR-RC-(H) power regenerative converter or FR-CV-(H) power regenerative common converter.
- Brake unit and regenerative options (Regenerative resistor) cannot be used simultaneously.

Connect the brake unit to the bus of the servo amplifier. As compared to the MR-RB regenerative option, the brake unit can return larger power. Use the brake unit when the regenerative option cannot provide sufficient regenerative capability.
When using the brake unit, set "_ _ 0 1" in [Pr. 2].
When using the brake unit, always refer to "FR-BU2 Brake Unit Instruction Manual".

11.3.1 Selection

Use a combination of the servo amplifier, brake unit and resistor unit listed below.

Brake unit		Resistor unit	Number of connected units	Permissible continuous power [kW]	Resultant resistance [Ω]	Applicable servo amplifier (Note 3)
200 V class	FR-BU2-15K	FR-BR-15K	1	0.99	8	MR-J4-500B-RJ020 (Note 1)
			2 (parallel)	1.98	4	MR-J4-500B-RJ020 MR-J4-700B-RJ020 MR-J4-11KB-RJ020 MR-J4-15KB-RJ020
	FR-BU2-30K	FR-BR-30K	1	1.99	4	MR-J4-500B-RJ020 MR-J4-700B-RJ020 MR-J4-11KB-RJ020 MR-J4-15KB-RJ020
	FR-BU2-55K	FR-BR-55K	1	3.91	2	MR-J4-11KB-RJ020 MR-J4-15KB-RJ020 MR-J4-22KB-RJ020
		MT-BR5-55K	1	5.5	2	MR-J4-22KB-RJ020
400 V class	FR-BU2-H30K	FR-BR-H30K	1	1.99	16	MR-J4-500B4-RJ020 MR-J4-700B4-RJ020 MR-J4-11KB4-RJ020 (Note 2)
	FR-BU2-H55K	FR-BR-H55K	1	3.91	8	MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020 MR-J4-22KB4-RJ020
	FR-BU2-H75K	MT-BR5-H75K	1	7.5	6.5	MR-J4-22KB4-RJ020

Note 1. Only when using the HG-RR353/HG-UR352 servo motor
2. When HG-JR11K1M4 servo motor is used, limit the torque during power running to 180% or less, or the servo motor speed to 1800 r/min or less.
3. When the brake unit is selected by using the capacity selection software, other combinations may be shown. Refer to the display on the capacity selection software for detailed combinations.

11.3.2 Brake unit parameter setting

Whether a parameter can be changed or not is listed below.

Parameter		Change possible/ impossible	Remarks
No.	Name		
0	Brake mode switchover	Impossible	Do not change the parameter.
1	Monitor display data selection	Possible	Refer to "FR-BU2 Brake Unit Instruction Manual".
2	Input terminal function selection 1	Impossible	Do not change the parameter.
3	Input terminal function selection 2		
77	Parameter write selection		
78	Cumulative energization time carrying-over times		
CLr	Parameter clear		
ECL	Alarm history clear		
C1	For manufacturer setting		

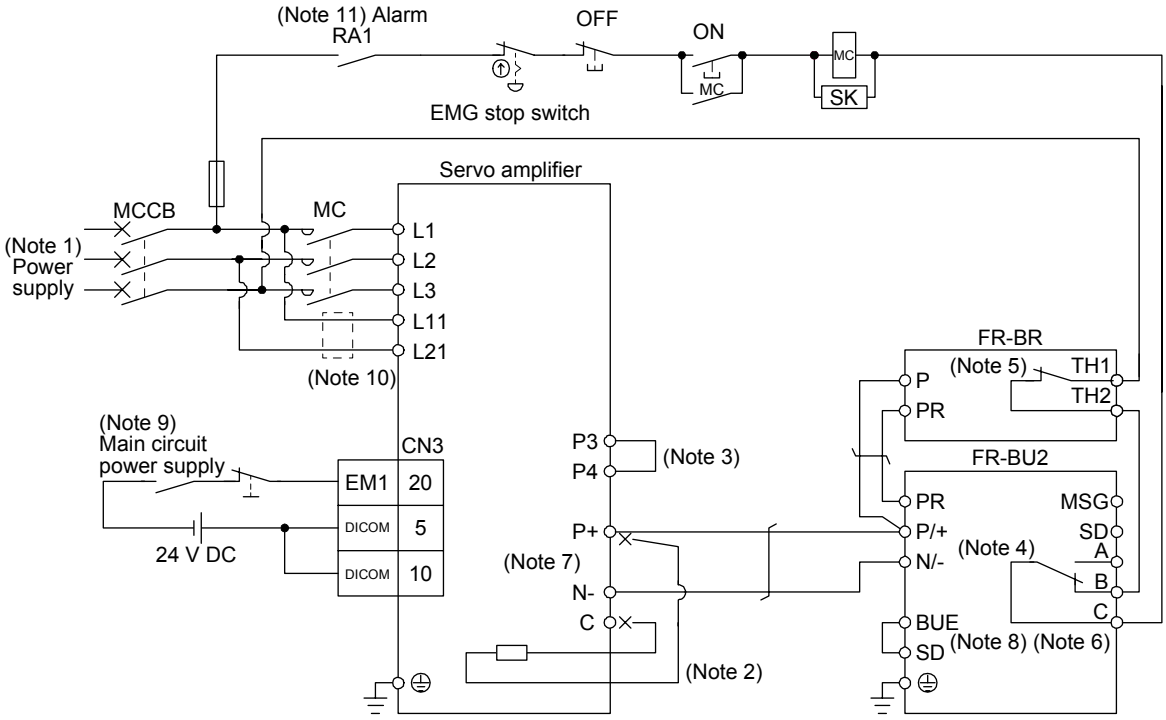
11.3.3 Connection example

POINT
●Connecting the PR terminal of the brake unit to te P+ terminal of the servo amplifier results in a brake unit malfunction. Always connect the PR terminal of the brake unit to the PR terminal of the resistor unit.

(1) Combination of the FR-BU2-(H) brake unit and FR-BR-(H) resistor unit

(a) When connecting a brake unit to a servo amplifier

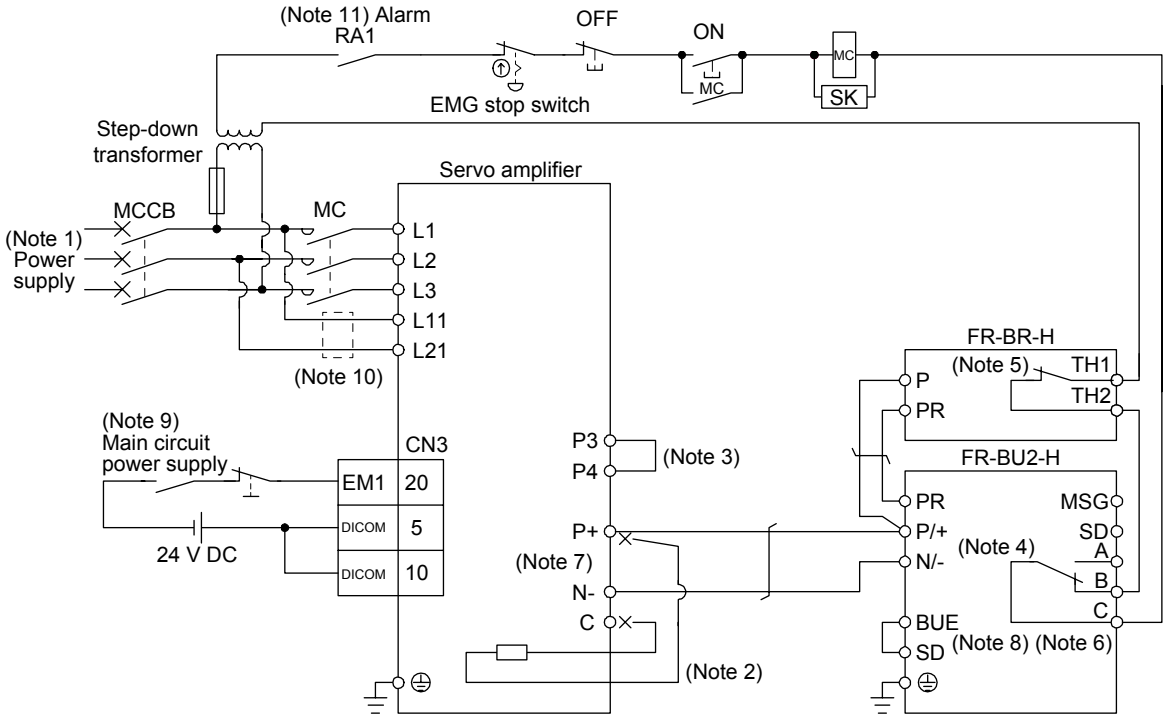
1) 200 V class



Note 1. For the power supply specifications, refer to section 1.3.

2. For the servo amplifier of 7 kW, always disconnect the lead wire of built-in regenerative resistor across the P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect the P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection results in a servo amplifier and brake unit malfunction.
5. Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
7. Do not connect more than one cable to each of the P+ to N- terminals of the servo amplifier.
8. Always connect the wiring between BUE and SD terminals. (factory-wired)
9. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
11. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.

2) 400 V class



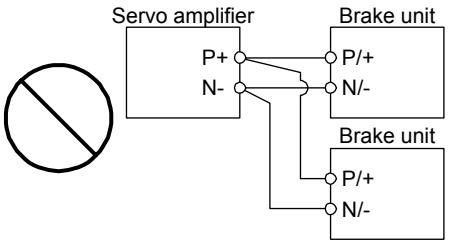
Note 1. For the power supply specifications, refer to section 1.3.

2. For the servo amplifier of 5 kW and 7 kW, always disconnect the lead wire of the built-in regenerative resistor across the P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect the P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection results in a servo amplifier and brake unit malfunction.
5. Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
7. Do not connect more than one cable to each of the P+ to N- terminals of the servo amplifier.
8. Always connect the wiring between BUE and SD terminals. (factory-wired)
9. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
11. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.

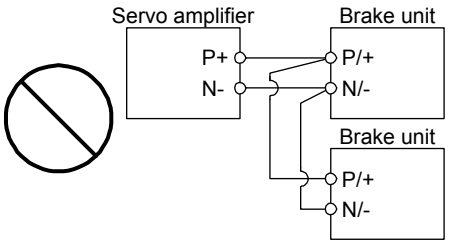
(b) When connecting two brake units to a servo amplifier

POINT

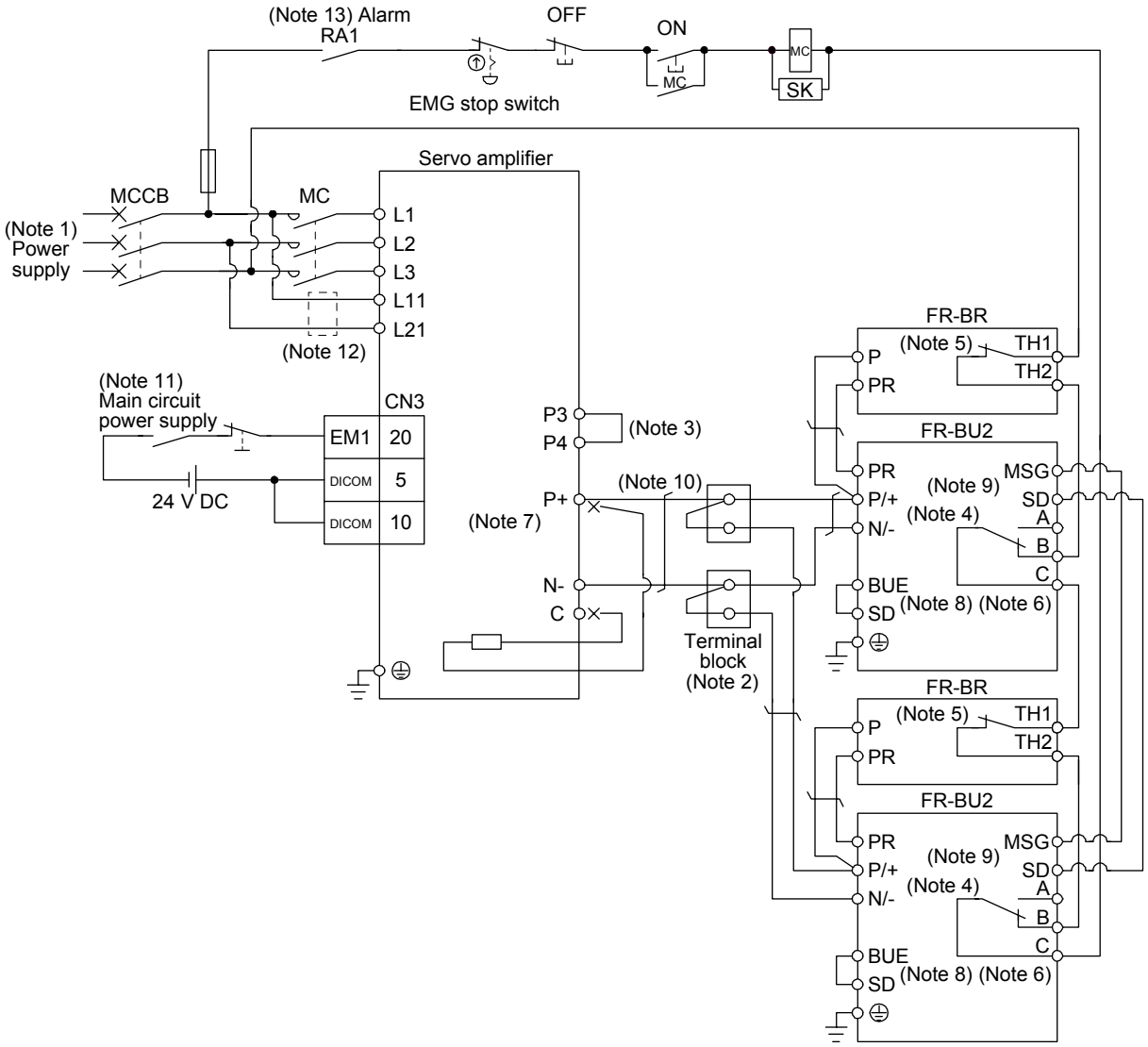
- For 400 V class servo amplifiers, two brake units cannot be connected with one servo amplifier.
- For parallel connection, use two sets of FR-BU2 brake unit. Combination with other brake unit results in alarm occurrence or malfunction.
- Always connect the terminals for master/slave (MSG to MSG, SD to SD) between the two brake units.
- Do not connect the servo amplifier and brake units as below. Connect the cables with a terminal block to distribute as indicated in this section.



Connecting two cables to P+ and N- terminals



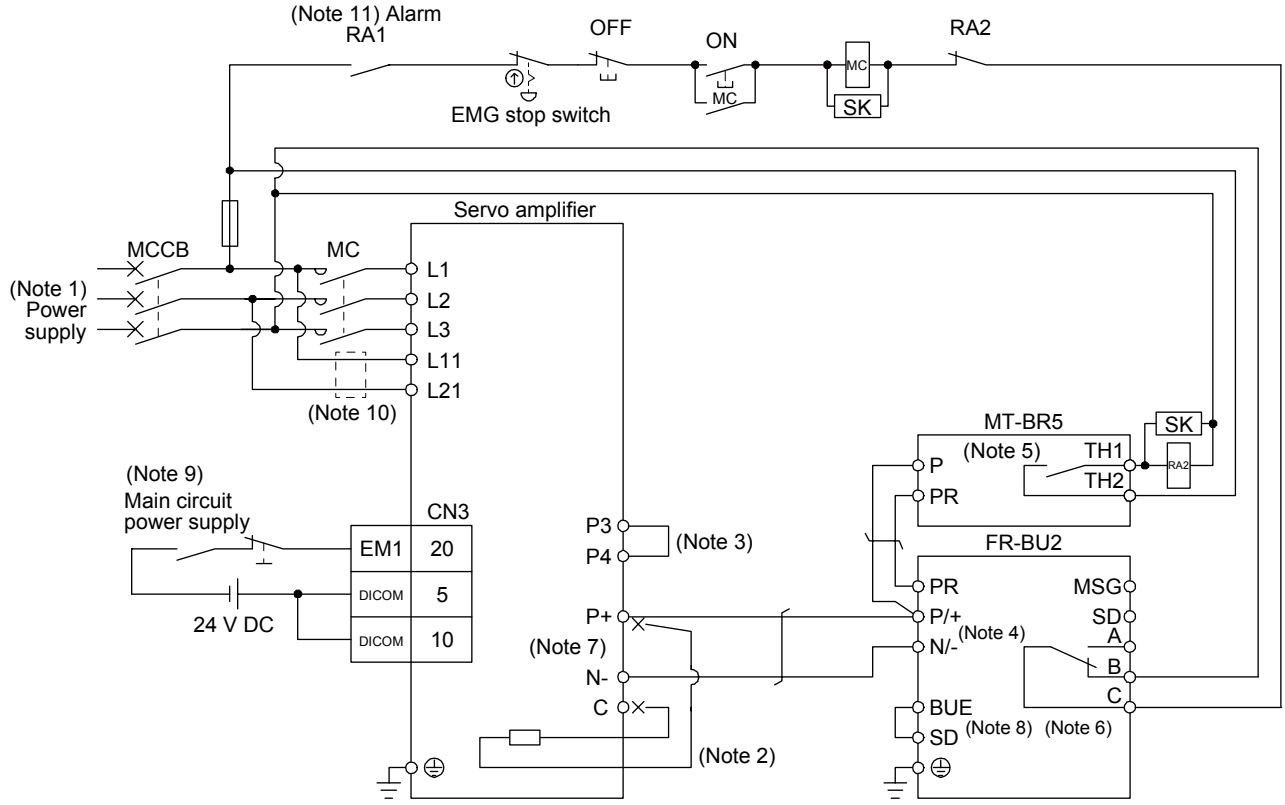
Passing wiring



Note
1. For the power supply specifications, refer to section 1.3.
2. For the servo amplifier of 7 kW, always disconnect the lead wire of built-in regenerative resistor across the P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect the P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection results in a servo amplifier and brake unit malfunction.
5. Contact rating: 1b contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting/A-C is not conducting. Abnormal condition: B-C is not conducting/A-C is conducting.
7. Do not connect more than one cable to each of the P+ to N- terminals of the servo amplifier.
8. Always connect the wiring between BUE and SD terminals. (factory-wired)
9. Connect the MSG and SD terminals of the brake unit to a correct destination. Incorrect connection results in a servo amplifier and brake unit malfunction.
10. For connecting the P+ and N- terminals of the servo amplifier to the terminal block, use the cable indicated in (3) (b) of this section.
11. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
12. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
13. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.

(2) Combination with MT-BR5-(H) resistor unit

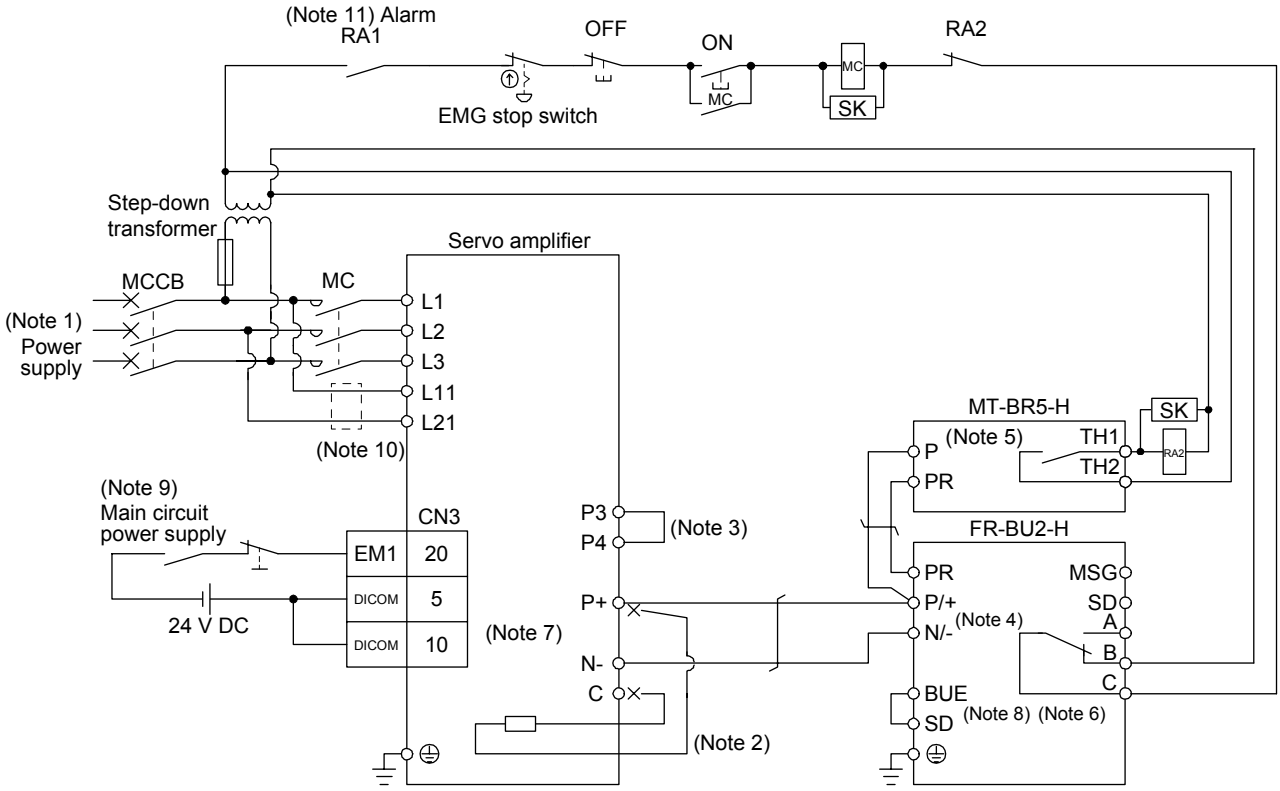
1) 200 V class



Note 1. For the power supply specifications, refer to section 1.3.

2. Please do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
5. Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
7. Do not connect more than one cable to each P+ to N- terminals of the servo amplifier.
8. Always connect BUE and SD terminals. (factory-wired)
9. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
11. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

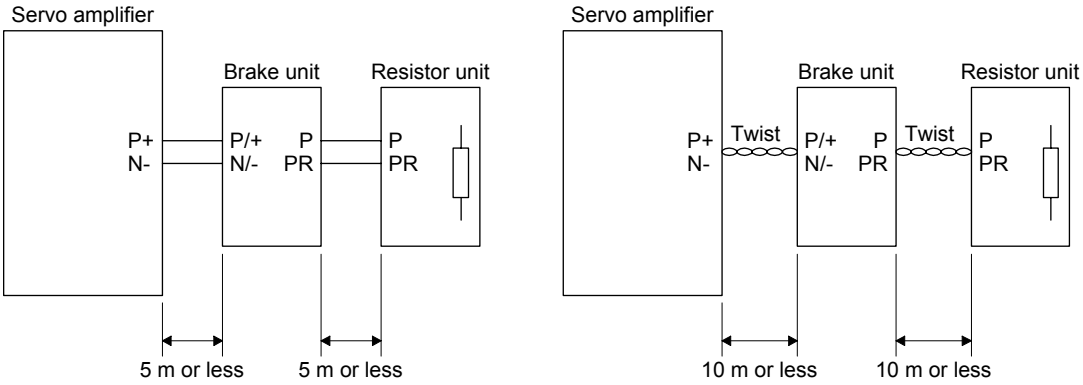
2) 400 V class



Note
1. For the power supply specifications, refer to section 1.3.
2. Please do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
4. Connect P/+ and N/- terminals of the brake unit to a correct destination. Incorrect connection destination results in servo amplifier and brake unit malfunction.
5. Contact rating: 1a contact, 110 V AC, 5 A/220 V AC, 3 A
   Normal condition: TH1-TH2 is not conducting. Abnormal condition: TH1-TH2 is conducting.
6. Contact rating: 230 V AC, 0.3 A/30 V DC, 0.3 A
   Normal condition: B-C is conducting./A-C is not conducting. Abnormal condition: B-C is not conducting./A-C is conducting.
7. Do not connect more than one cable to each P+ to N- terminals of the servo amplifier.
8. Always connect BUE and SD terminals. (factory-wired)
9. Configure a circuit to turn off EM1 when the main circuit power is turned off to prevent an unexpected restart of the servo amplifier.
10. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
11. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.

(2) Connection instructions

The cables between the servo amplifier and the brake unit, and between the resistor unit and the brake unit should be as short as possible. Always twist the cable longer than 5 m (twist five times or more per one meter). Even when the cable is twisted, the cable should be less than 10 m. Using cables longer than 5 m without twisting or twisted cables longer than 10 m may result in the brake unit malfunction.

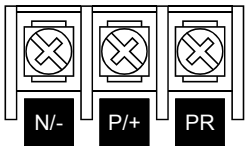


(3) Wires

(a) Wires for the brake unit

For the brake unit, the HIV wire (600 V grade heat-resistant polyvinyl chloride insulated wire) is recommended.

1) Main circuit terminal

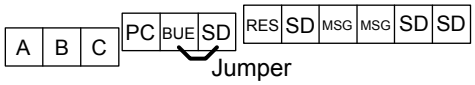


Terminal block

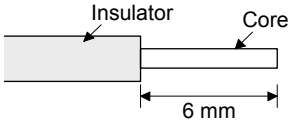
Brake unit		Main circuit terminal screw size	Crimp terminal N/-, P/+, PR, ⏚	Tightening torque [N•m]	Wire size N/-, P/+, PR, ⏚	
					HIV wire [mm^2]	AWG
200 V class	FR-BU2-15K	M4	5.5-4	1.5	3.5	12
	FR-BU2-30K	M5	5.5-5	2.5	5.5	10
	FR-BU2-55K	M6	14-6	4.4	14	6
400 V class	FR-BU2-H30K	M4	5.5-4	1.5	3.5	12
	FR-BU2-H55K	M5	5.5-5	2.5	5.5	10
	FR-BU2-H75K	M6	14-6	4.4	14	6

2) Control circuit terminal

POINT
●Under tightening can cause a cable disconnection or malfunction. Over tightening can cause a short circuit or malfunction due to damage to the screw or the brake unit.



Terminal block



Wire the stripped cable after twisting to prevent the cable from becoming loose. In addition, do not solder it.

Screw size: M3

Tightening torque: 0.5 N•m to 0.6 N•m

Wire size: 0.3 mm^2 to 0.75 mm^2

Screw driver: Small flat-blade screwdriver

(Tip thickness: 0.4 mm/Tip width 2.5 mm)

(b) Cables for connecting the servo amplifier and a distribution terminal block when connecting two sets of the brake unit

Brake unit	Wire size	
	HIV wire [mm^2]	AWG
FR-BU2-15K	8	8

(4) Crimp terminals for the P+ and N- terminals of servo amplifier

(a) Recommended crimp terminals

POINT

●Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

Servo amplifier		Brake unit	Number of connected units	Crimp terminal (Manufacturer)	(Note 1) Applicable tool
200 V class	MR-J4-500B-RJ020	FR-BU2-15K	1	FVD5.5-S4 (JST)	a
			2	8-4NS (JST) (Note 2)	b
		FR-BU2-30K	1	FVD5.5-S4 (JST)	a
	MR-J4-700B-RJ020	FR-BU2-15K	2	8-4NS (JST) (Note2)	b
		FR-BU2-30K	1	FVD5.5-S4 (JST)	a
	MR-J4-11KB-RJ020	FR-BU2-15K	2	FVD8-6 (JST)	c
		FR-BU2-30K	1	FVD5.5-6 (JST)	a
		FR-BU2-55K	1	FVD14-6 (JST)	d
	MR-J4-15KB-RJ020	FR-BU2-15K	2	FVD8-6 (JST)	c
		FR-BU2-30K	1	FVD5.5-6 (JST)	a
		FR-BU2-55K	1	FVD14-6 (JST)	d
	MR-J4-22KB-RJ020	FR-BU2-55K	1	FVD14-8 (JST)	d
400 V class	MR-J4-500B4-RJ020	FR-BU2-H30K	1	FVD5.5-S4 (JST)	a
	MR-J4-700B4-RJ020	FR-BU2-H30K	1	FVD5.5-S4 (JST)	a
	MR-J4-11KB4-RJ020	FR-BU2-H30K	1	FVD5.5-6 (JST)	a
		FR-BU2-H55K	1	FVD5.5-6 (JST)	a
	MR-J4-15KB4-RJ020	FR-BU2-H55K	1	FVD5.5-6 (JST)	a
	MR-J4-22KB4-RJ020	FR-BU2-H55K	1	FVD5.5-8 (JST)	a
		FR-BU2-H75K	1	FVD14-8 (JST)	d

Note 1. Symbols in the applicable tool field indicate applicable tools in (4)(b) of this section.
2. Coat the crimped part with an insulation tube.

(b) Applicable tool

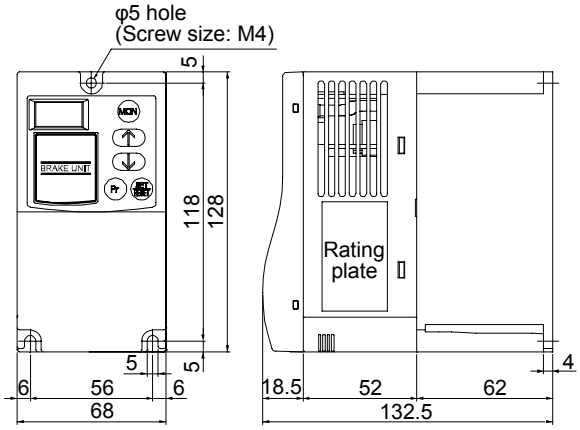
Symbol	Servo amplifier-side crimp terminals				
	Crimp terminal	Applicable tool			Manufacturer
		Body	Head	Dice	
a	FDV5.5-S4 FDV5.5-6	YNT-1210S			JST
b	8-4NS	YHT-8S			
c	FVD8-6	YF-1 E-4	YNE-38	DH-111 DH-121	
d	FVD14-6 FVD14-8	YF-1 E-4	YNE-38	DH-112 DH-122	

11.3.4 Dimensions

(1) FR-BU2-(H) brake unit

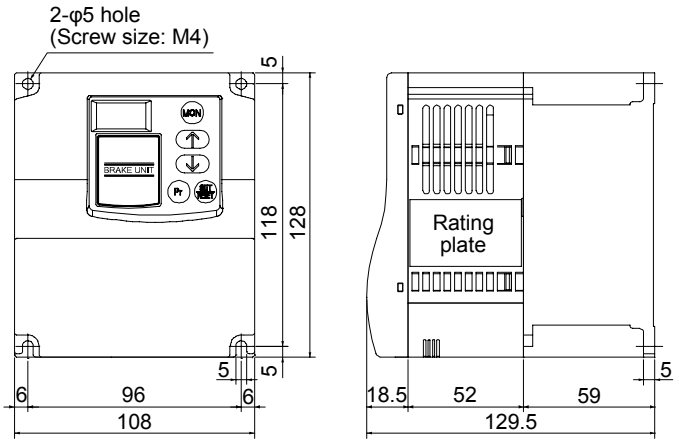
FR-BU2-15K

[Unit: mm]



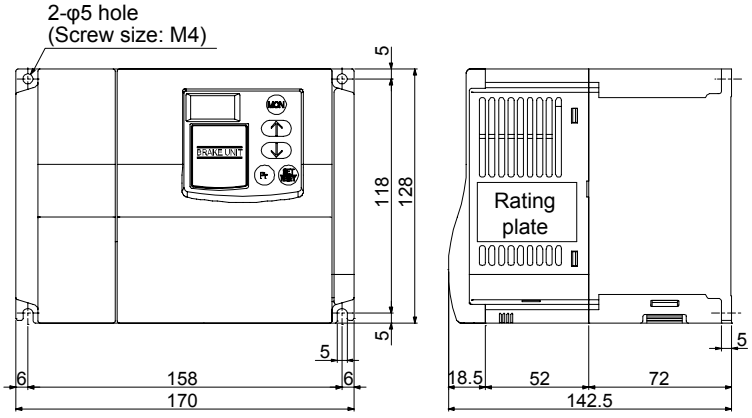
FR-BU2-30K/FR-BU2-H30K

[Unit: mm]



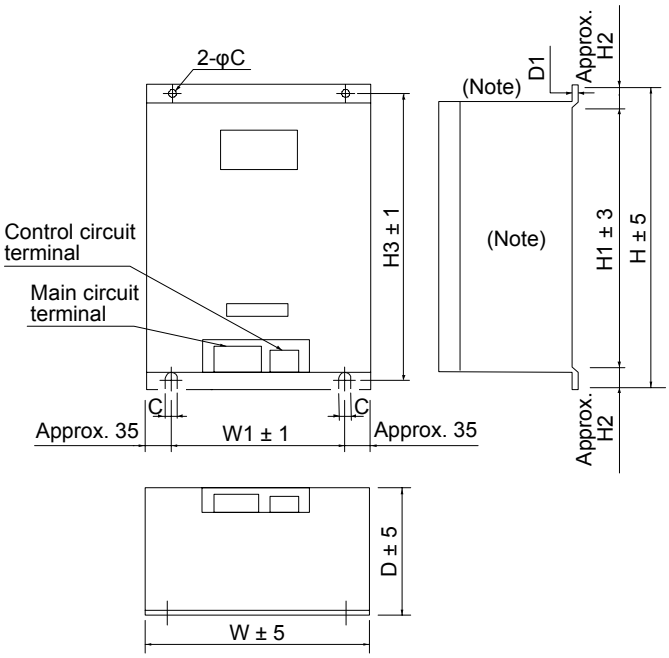
FR-BU2-55K/FR-BU2-H55K/FR-BU2-H75K

[Unit: mm]



(2) FR-BR- (H) resistor unit

[Unit: mm]

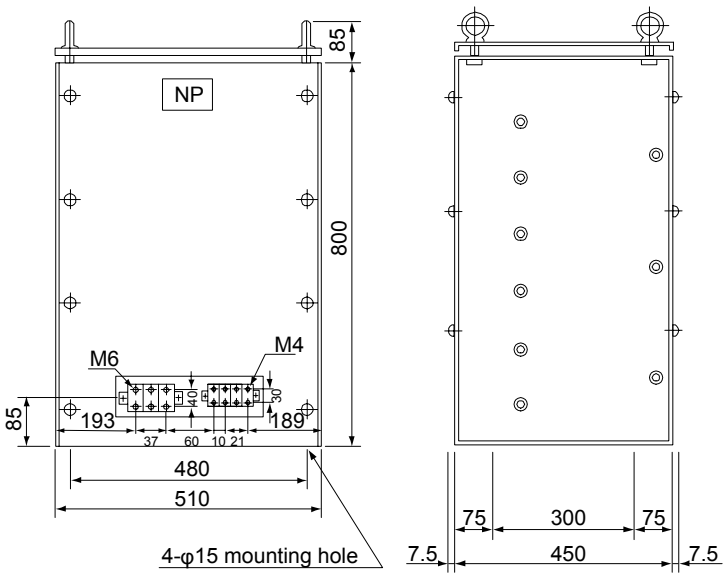


Note. Ventilation ports are provided on both sides and the top. The bottom is open.

Resistor unit		W	W1	H	H1	H2	H3	D	D1	C	Approximate mass [kg]
200 V class	FR-BR-15K	170	100	450	410	20	432	220	3.2	6	15
	FR-BR-30K	340	270	600	560	20	582	220	4	10	30
	FR-BR-55K	480	410	700	620	40	670	450	3.2	12	70
400 V class	FR-BR-H30K	340	270	600	560	20	582	220	4	10	30
	FR-BR-H55K	480	410	700	620	40	670	450	3.2	12	70

(3) MT-BR5-(H) resistor unit

[Unit: mm]



Resistor unit		Resistance	Approximate mass [kg]
200 V class	MT-BR5-55K	2.0 Ω	50
400 V class	MT-BR5-H75K	6.5 Ω	70

11.4 FR-RC-(H) power regenerative converter

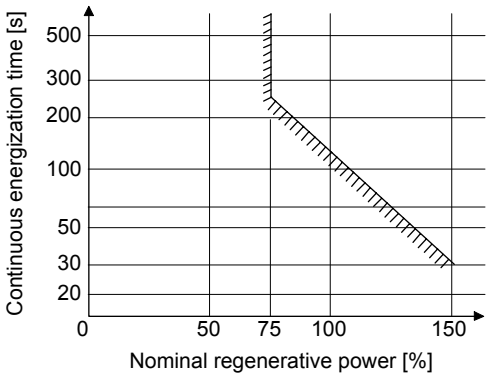
POINT
●When using the FR-RC-(H) power regenerative converter, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

When using the FR-RC-(H) power regenerative converter, set "_ _ 0 1" in [Pr. 2].

(1) Selection

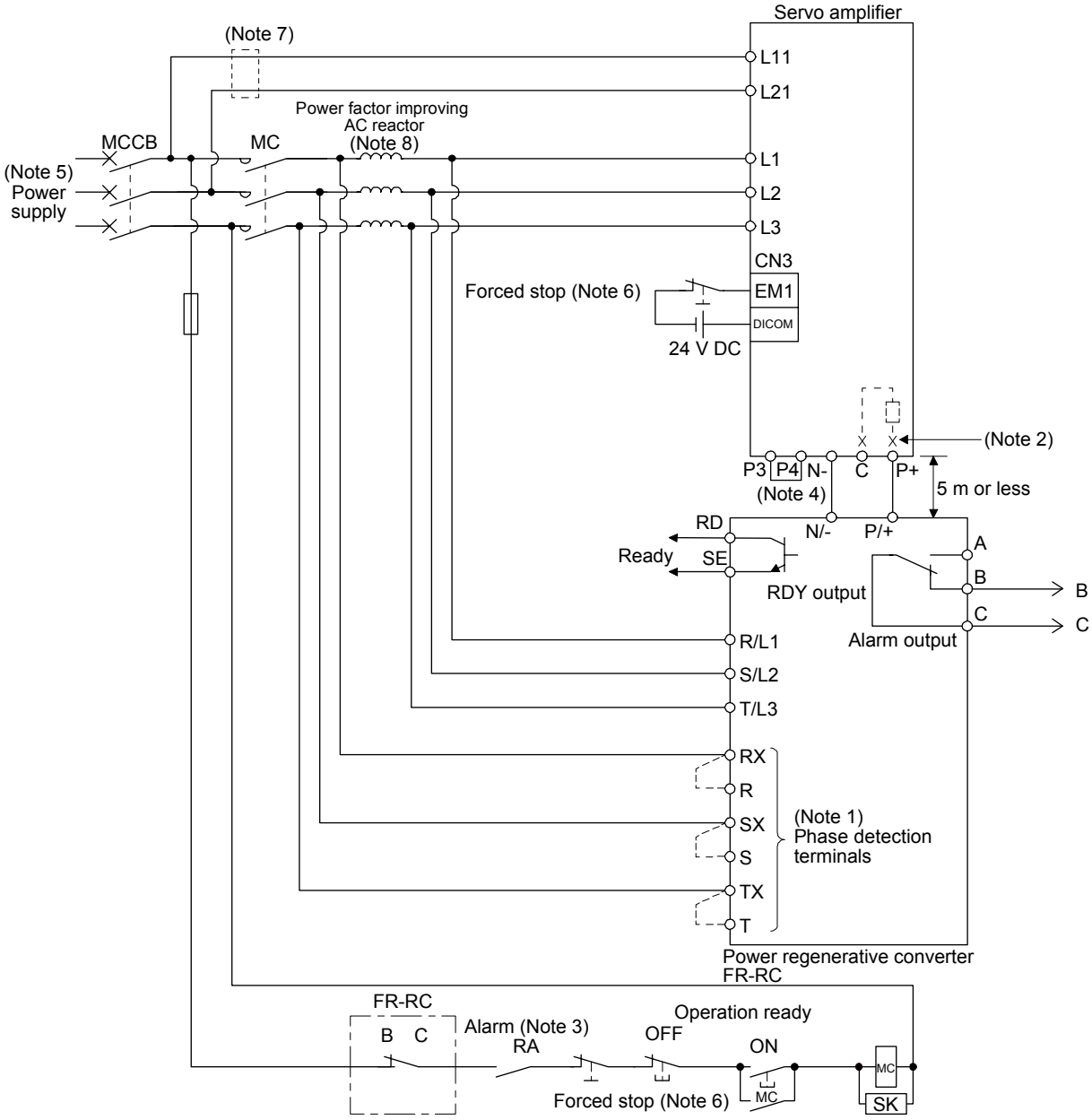
The converters can continuously return 75% of the nominal regenerative power. They are applied to the servo amplifiers of 5 kW to 22 kW.

Power regenerative converter	Nominal regenerative power [kW]	Servo amplifier
FR-RC-15K	15	MR-J4-500B-RJ020 MR-J4-700B-RJ020
FR-RC-30K	30	MR-J4-11KB-RJ020 MR-J4-15KB-RJ020
FR-RC-55K	55	MR-J4-22KB-RJ020
FR-RC-H15K	15	MR-J4-500B4-RJ020 MR-J4-700B4-RJ020
FR-RC-H30K	30	MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020
FR-RC-H55K	55	MR-J4-22KB4-RJ020



(2) Connection example

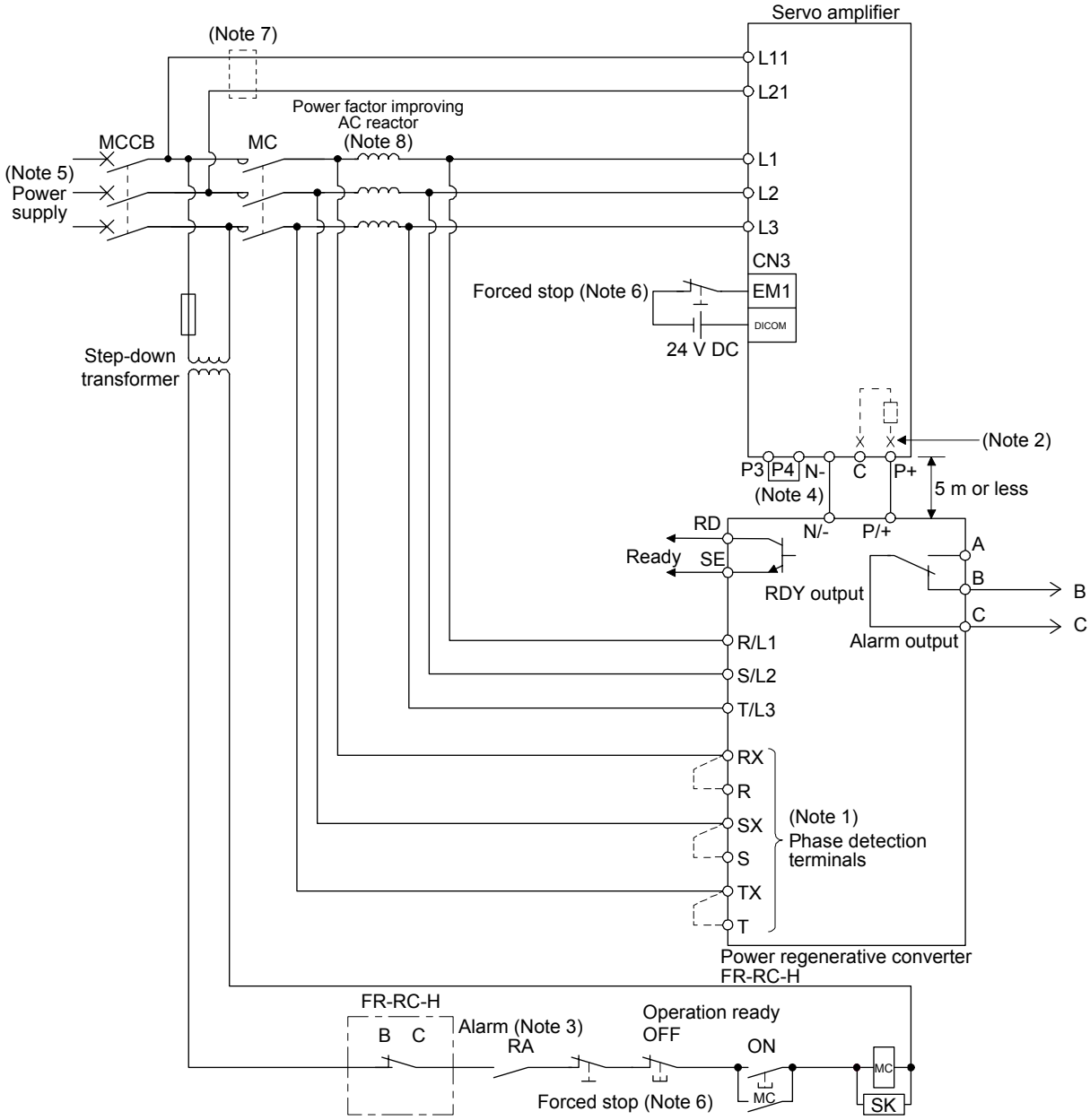
(a) 200 V class



Note 1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC will not operate.

2. For the servo amplifier of 7 kW, always disconnect the lead wire of built-in regenerative resistor across the P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.
4. Between P3 and P4 is connected by default.
5. For the power supply specifications, refer to section 1.3.
6. Configure the circuit which shuts off main circuit power with external circuit at EM1 (Forced stop) off.
7. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
8. For selection of power factor improving AC reactors, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

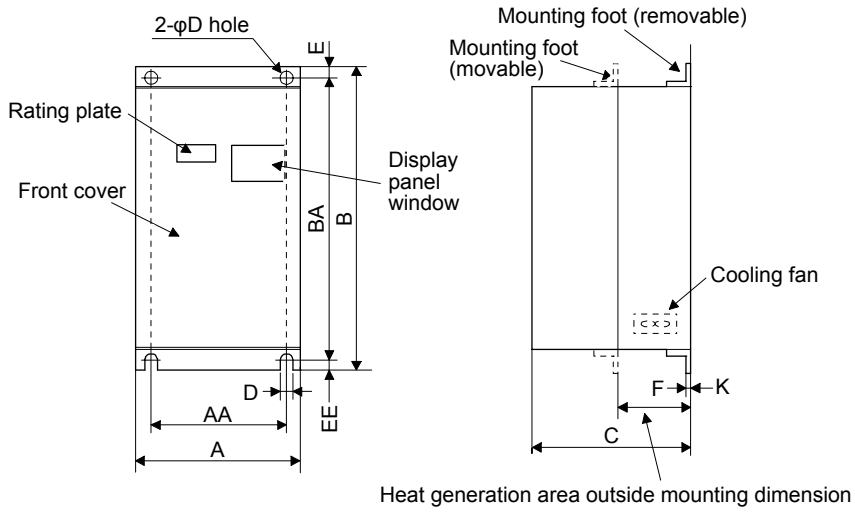
(b) 400 V class



Note 1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC-H will not operate.

2. For the servo amplifier of 5 kW and 7 kW, always disconnect the lead wire of the built-in regenerative resistor across the P+ and C terminals. For the servo amplifier of 11 kW to 22 kW, do not connect a supplied regenerative resistor to the P+ and C terminals.
3. Configure the power supply circuit which turns off the magnetic contactor after detection of an alarm occurrence on the controller side.
4. Between P3 and P4 is connected by default.
5. For the power supply specifications, refer to section 1.3.
6. Configure the circuit which shuts off main circuit power with external circuit at EM1 (Forced stop) off.
7. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
8. For selection of power factor improving AC reactors, refer to "Power Regeneration Converter FR-RC Instruction Manual (IB(NA)66330)".

(3) Dimensions

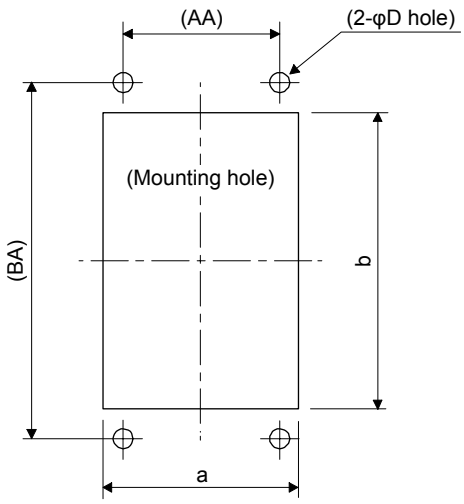


[Unit: mm]

Power regenerative converter	A	AA	B	BA	C	D	E	EE	K	F	Approximate mass [kg]
FR-RC-15K	270	200	450	432	195	10	10	8	3.2	87	19
FR-RC-30K	340	270	600	582	195	10	10	8	3.2	90	31
FR-RC-55K	480	410	700	670	250	12	15	15	3.2	135	55
FR-RC-H15K	340	270	600	582	195	10	10	8	3.2	90	31
FR-RC-H30K											
FR-RC-H55K	480	410	700	670	250	12	15	15	3.2	135	55

(4) Mounting hole machining dimensions

When the power regenerative converter is installed to an enclosed type cabinet, mount the heat generating area of the converter outside the box to provide heat generation measures. At this time, the mounting hole dimensions are as follows.



[Unit: mm]

Power regenerative converter	a	b	D	AA	BA
FR-RC-15K	260	412	10	200	432
FR-RC-30K	330	562	10	270	582
FR-RC-55K	470	642	12	410	670
FR-RC-H15K	330	562	10	270	582
FR-RC-H30K					
FR-RC-H55K	470	642	12	410	670

11.5 FR-CV-(H) power regenerative common converter

POINT

- For details of the power regenerative common converter FR-CV-(H), refer to "FR-CV Instruction Manual (IB(NA)0600075)".
- Do not supply power to the main circuit power supply terminals (L1, L2, and L3) of the servo amplifier. Doing so will cause a malfunction of the servo amplifier and FR-CV-(H).
- Connect the DC power supply between the FR-CV-(H) and servo amplifier with correct polarity. Connection with incorrect polarity will cause a malfunction of the FR-CV-(H) and servo amplifier.
- Using two or more FR-CV-(H)s will not improve regeneration capability. Two or more FR-CV-(H)s cannot be connected to the same DC power supply line.

When using the FR-CV-(H) power regenerative common converter, set "_ _ 0 1" in [Pr. 2].

11.5.1 Model definition

The following describes what each block of a model name indicates.

FR-CV-H 7.5K

Capacity

Symbol	Capacity [kW]
7.5K	7.5
11K	11
15K	15
22K	22
30K	30
37K	37
55K	55

Symbol	Voltage class
None	200 V class
H	400 V class

11.5.2 Selection

(1) 200 V class

FR-CV power regenerative common converter can be used for the servo amplifier of 100 W to 22 kW. The following shows the restrictions on using the FR-CV.

(a) Up to six servo amplifiers can be connected to one FR-CV.

(b) FR-CV capacity [W] ≥ Total of the rated capacities of servo amplifiers connected to FR-CV [W] × 2

(c) The total of used servo motor rated currents should be equal to or less than the applicable current [A] of the FR-CV.

(d) Among the servo amplifiers connected to the FR-CV, the maximum capacity should be equal to or less than the maximum connectable capacity [W].

The following table lists the restrictions.

Item	FR-CV-_						
	7.5K	11K	15K	22K	30K	37K	55K
Maximum number of connected servo amplifiers	6						
Total capacity of connectable servo amplifiers [kW]	3.75	5.5	7.5	11	15	18.5	27.5
Total rated current of connectable servo motors [A]	33	46	61	90	115	145	215
Maximum servo amplifier capacity [kW]	3.5	5	7	11	15	15	22

When using FR-CV, always install the dedicated stand-alone reactor (FR-CVL).

Power regenerative common converter	Dedicated stand-alone reactor
FR-CV-7.5K(-AT)	FR-CVL-7.5K
FR-CV-11K(-AT)	FR-CVL-11K
FR-CV-15K(-AT)	FR-CVL-15K
FR-CV-22K(-AT)	FR-CVL-22K
FR-CV-30K(-AT)	FR-CVL-30K
FR-CV-37K	FR-CVL-37K
FR-CV-55K	FR-CVL-55K

(2) 400 V class

FR-CV-H power regenerative common converter can be used for the servo amplifier of 11 kW to 22 kW. The following shows the restrictions on using the FR-CV-H.

(a) Up to two servo amplifiers can be connected to one FR-CV-H.

(b) FR-CV-H capacity [W] ≥ Total of rated capacities [W] × 2 of servo amplifiers connected to FR-CV-H.

(c) The total of used servo motor rated currents should be equal to or less than the applicable current [A] of the FR-CV-H.

(d) Among the servo amplifiers connected to the FR-CV-H, the servo amplifier of the maximum capacity should be equal to or less than the maximum connectable capacity [W].

The following table lists the restrictions.

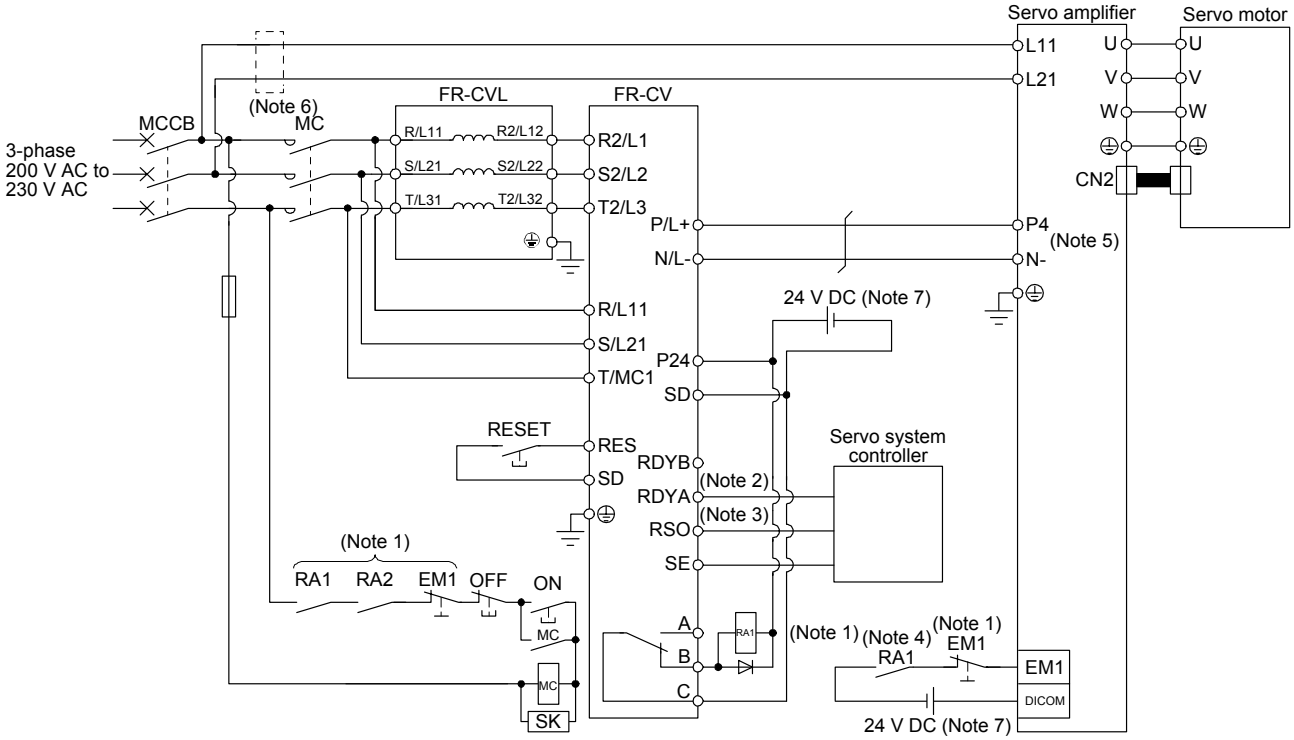
Item	FR-CV-H_			
	22K	30K	37K	55K
Maximum number of connected servo amplifiers	1			2
Total capacity of connectable servo amplifiers [kW]	11	15	18.5	27.5
Total rated current of connectable servo motors [A]	43	57	71	110
Maximum servo amplifier capacity [kW]	11	15	15	22

When using the FR-CV-H, always install the dedicated stand-alone reactor (FR-CVL-H).

Power regenerative common converter	Dedicated stand-alone reactor
FR-CV-H22K(-AT)	FR-CVL-H22K
FR-CV-H30K(-AT)	FR-CVL-H30K
FR-CV-H37K	FR-CVL-H37K
FR-CV-H55K	FR-CVL-H55K

(3) Connection diagram

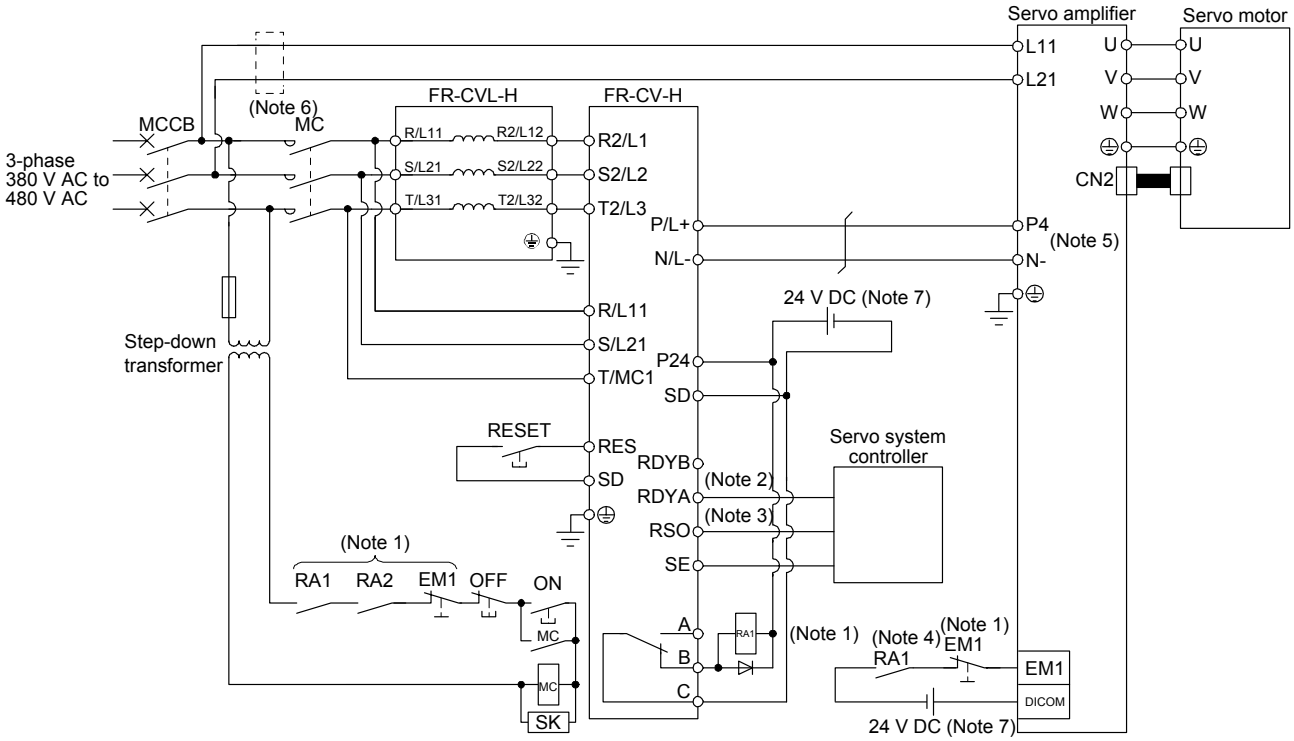
(a) 200 V class



Note 1. Configure a sequence that will shut off main circuit power in the following.
- An alarm occurred at FR-CV or the servo amplifier.
- EM1 (Forced stop) is enabled.

2. For the servo amplifier, configure a sequence that will switch the servo-on after FR-CV is ready.
3. FR-CV turns off the RSO signal after it gets ready by the reset signal input. Configure a sequence that will make the servo inoperative when the RSO signal is on.
4. Configure a sequence that will stop the servo amplifier with the emergency stop input of the servo system controller if an alarm occurs in the FR-CV. When the servo system controller does not have an emergency stop input, use the forced stop input of the servo amplifier to stop the servo amplifier as shown in the diagram.
5. When using FR-CV, always disconnect the wiring between P3 and P4 terminals.
6. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
7. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

(b) 400 V class



Note 1. Configure a sequence that will shut off main circuit power in the following.
- An alarm occurred at FR-CV-H or servo amplifier.
- EM1 (Forced stop) is enabled.

2. For the servo amplifier, configure a sequence that will switch the servo-on after the FR-CV-H is ready.
3. For the FR-CV-H, the RSO signal turns off when it is put in a ready-to-operate status where the reset signal is input. Configure a sequence that will make the servo inoperative when the RSO signal is on.
4. Configure a sequence that will make a stop with the emergency stop input of the servo system controller if an alarm occurs in the FR-CV-H. When the servo system controller does not have an emergency stop input, use the forced stop input of the servo amplifier to make a stop as shown in the diagram.
5. When using FR-CV-H, always disconnect wiring between P3 and P4 terminals.
6. When wires used for L11 and L21 are thinner than wires used for L1, L2, and L3, use a molded-case circuit breaker.
7. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.

(4) Selection example of wires used for wiring

POINT

●The wire size selection conditions are as follows.
Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Construction condition: Single wire set in the air

(a) Wire size

1) Between P and P4, and between N and N-

The following table indicates the connection wire size for the DC power supply (P4, N- terminals) between the FR-CV and servo amplifier.

Total of servo amplifier capacities [kW]	Wire [mm^2]
1 or less	2 (AWG 14)
2	3.5 (AWG 12)
5	5.5 (AWG 10)
7	8 (AWG 8)
11	14 (AWG 6)
15	22 (AWG 4)
22	50 (AWG 2)

The following table indicates the connection wire size for the DC power supply (P4, N- terminals) between the FR-CV-H and servo amplifier.

Total of servo amplifier capacities [kW]	Wire [mm^2]
11	8 (AWG 8)
15	8 (AWG 8)
22	14 (AWG 6)

2) Grounding

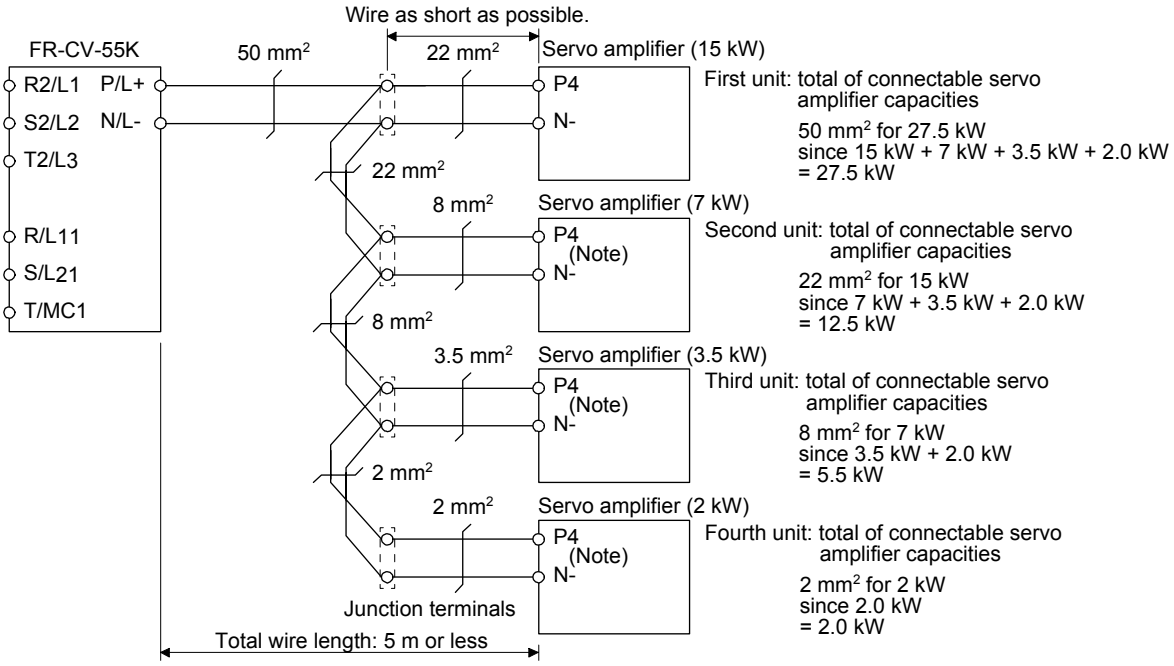
For grounding, use the wire of the size equal to or greater than that indicated in the following table, and make it as short as possible.

Power regenerative common converter	Grounding wire size [mm^2]
FR-CV-7.5K to FR-CV-15K	8 (AWG 8)
FR-CV-22K/FR-CV-30K	22 (AWG 4)
FR-CV-37K/FR-CV-55K	38 (AWG 2)
FR-CV-H22K/FR-CV-H30K	8 (AWG 8)
FR-CV-H37K/FR-CV-H55K	14 (AWG 6)

(b) Example of the wire size selection

1) 200 V class

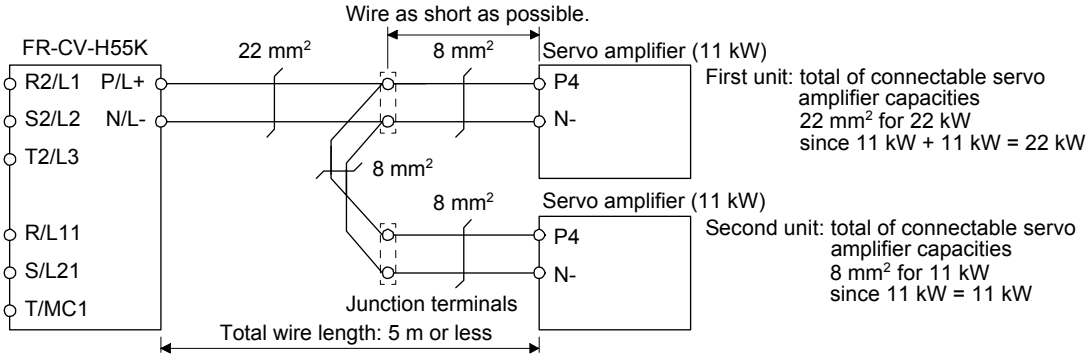
When connecting multiple servo amplifiers, always use junction terminals for wiring to the servo amplifier terminals P4 and N-. Also, connect the servo amplifiers in the order of larger to smaller capacities.



Note. When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: across P+ and D, 7 kW: across P+ and C).

2) 400 V class

When connecting two servo amplifiers of 11 kW, always use junction terminals for wiring the servo amplifier terminals P4 and N-.



(5) Other precautions

(a) When using the FR-CV-(H), always install the dedicated stand-alone reactor (FR-CVL-(H)). Do not use the power factor improving AC reactor (FR-HAL-(H)) or power factor improving DC reactor (FR-HEL-(H)).

(b) The inputs/outputs (main circuits) of the FR-CV-(H) and servo amplifiers include high-frequency components and may provide electromagnetic wave interference to communication equipment (such as AM radios) used near them. In this case, interference can be reduced by installing the radio noise filter (FR-BIF-(H)) or line noise filter (FR-BSF01, FR-BLF).

(c) The overall wiring length for connection of the DC power supply between the FR-CV-(H) and servo amplifiers should be 5 m or less, and the wiring must be twisted.

(6) Specifications

Item \ Power regenerative common converter FR-CV-_			7.5K	11K	15K	22K	30K	37K	55K
Total capacity of connectable servo amplifiers [kW]			3.75	5.5	7.5	11	15	18.5	27.5
Maximum servo amplifier capacity [kW]			3.5	5	7	11	15	15	22
Output	Total of connectable servo motor rated currents [A]		33	46	61	90	115	145	215
Output	Regenerative braking torque	Short-time rating	Total capacity of applicable servo motors, 300% torque, 60 s (Note 1)						
Output	Regenerative braking torque	Continuous rating	100% torque						
Power supply	Rated input AC voltage/frequency		3-phase 200 V AC to 220 V AC, 50 Hz, 200 V AC to 230 V AC, 60 Hz						
Power supply	Permissible AC voltage fluctuation		3-phase 170 V AC to 242 V AC, 50 Hz, 170 V AC to 253 V AC, 60 Hz						
Power supply	Permissible frequency fluctuation		±5%						
Power supply	Power supply capacity (Note 2) [kVA]		17	20	28	41	52	66	100
IP rating (JEM 1030), cooling method			Open type (IP00), forced cooling						
Environment	Ambient temperature		-10 ˚C to 50 ˚C (non-freezing)						
Environment	Ambient humidity		90 %RH or less (non-condensing)						
Environment	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt						
Altitude, vibration resistance			1000 m or less above sea level, 5.9 m/s^2						
Molded-case circuit breaker or earth-leakage current breaker			30AF 30A	50AF 50A	100AF 75A	100AF 100A	125AF 125A	125AF 125A	225AF 175A
Magnetic contactor			S-N20	S-N35	S-N50	S-N65	S-N80	S-N95	S-N125

Item \ Power regenerative common converter FR-CV-H_			22K	30K	37K	55K
Total of connectable servo amplifier capacities [kW]			11	15	18.5	27.5
Maximum servo amplifier capacity [kW]			11	15	15	22
Output	Total of connectable servo motor rated currents [A]		43	57	71	110
Output	Regenerative braking torque	Short-time rating	Total capacity of applicable servo motors, 300% torque, 60 s (Note 1)			
Output	Regenerative braking torque	Continuous rating	100% torque			
Power supply	Rated input AC voltage/frequency		3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz			
Power supply	Permissible AC voltage fluctuation		3-phase 323 V AC to 528 V AC, 50 Hz/60 Hz			
Power supply	Permissible frequency fluctuation		±5%			
Power supply	Power supply capacity (Note 2) [kVA]		41	52	66	100
IP rating (JEM 1030), cooling method			Open type (IP00), forced cooling			
Environment	Ambient temperature		-10 ˚C to 50 ˚C (non-freezing)			
Environment	Ambient humidity		90 %RH or less (non-condensing)			
Environment	Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt			
Altitude, vibration resistance			1000 m or less above sea level, 5.9 m/s^2			
Molded-case circuit breaker or earth-leakage current breaker			50AF 50A	60AF 60A	100AF 75A	100AF 100A
Magnetic contactor			S-N25	S-N35	S-N50	S-N65

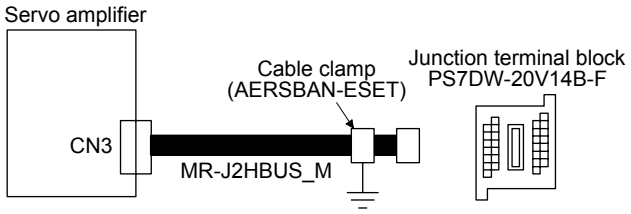
Note 1. This is the time when the protective function of the FR-CV-(H) is activated. The protective function of the servo amplifier is activated in the time indicated in section 10.1.

2. The specified value is the power supply capacity of FR-CV-(H). The total power supply capacities of the connected servo amplifiers are actually required.

11.6 Junction terminal block PS7DW-20V14B-F (recommended)

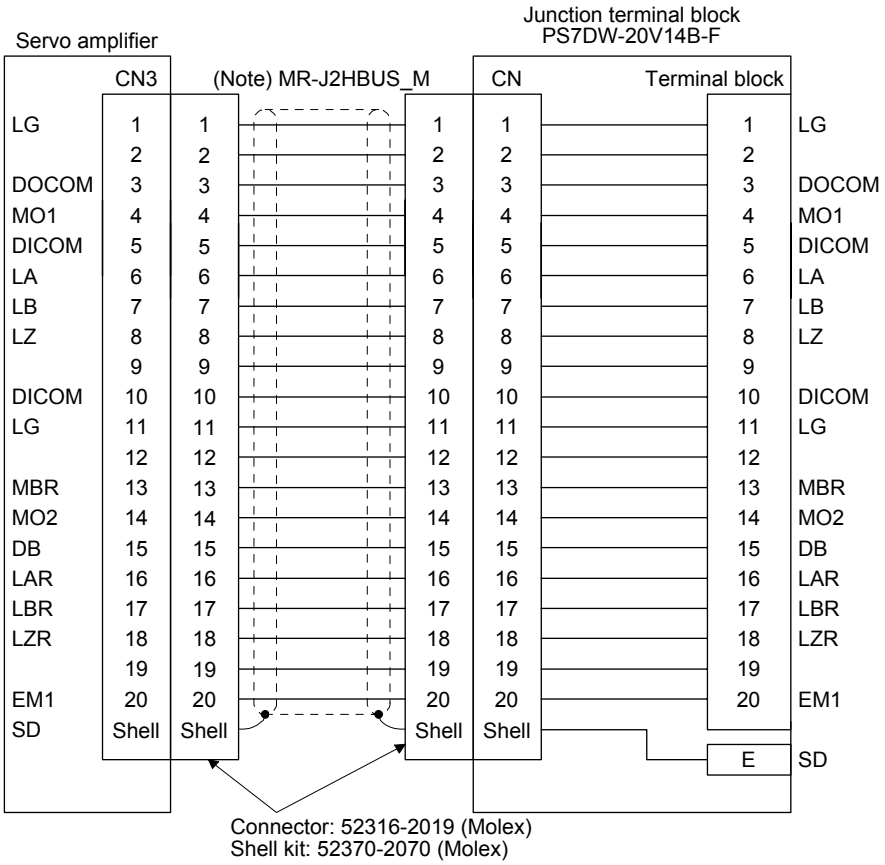
(1) Usage

Always use the junction terminal block PS7DW-20V14B-F (Yoshida Electric Industry) with the option cable (MR-J2HBUS_M). A connection example is shown below.



Ground the option cable on the junction terminal block side with the cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to section 11.14, (2) (c).

(2) Connection of MR-J2HBUS_M cable and junction terminal block


Junction terminal block
PS7DW-20V14B-F
Servo amplifier
CN3
(Note) MR-J2HBUS_M
CN
Terminal block
LG 1 1 1 1 1 LG
2 2 2 2 2
DOCOM 3 3 3 3 3 DOCOM
MO1 4 4 4 4 4 MO1
DICOM 5 5 5 5 5 DICOM
LA 6 6 6 6 6 LA
LB 7 7 7 7 7 LB
LZ 8 8 8 8 8 LZ
9 9 9 9 9
DICOM 10 10 10 10 10 DICOM
LG 11 11 11 11 11 LG
12 12 12 12 12
MBR 13 13 13 13 13 MBR
MO2 14 14 14 14 14 MO2
DB 15 15 15 15 15 DB
LAR 16 16 16 16 16 LAR
LBR 17 17 17 17 17 LBR
LZR 18 18 18 18 18 LZR
19 19 19 19 19
EM1 20 20 20 20 20 EM1
SD Shell Shell Shell Shell E SD
Connector: 52316-2019 (Molex)
Shell kit: 52370-2070 (Molex)

Note. The symbol indicating cable length is put in _.

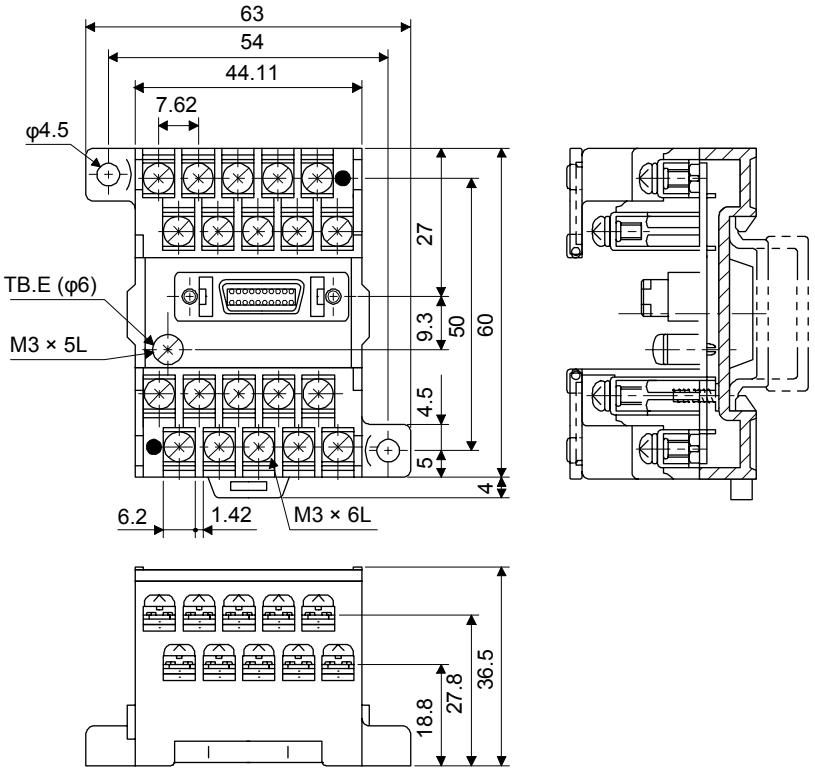
05: 0.5 m

1: 1 m

5: 5 m

(3) Dimensions of the junction terminal block

[Unit: mm]



11.7 MR Configurator

POINT
●For using MR Configurator with MR-J4-_B_-RJ020 servo amplifier, the restrictions apply to the MR-J2S-_B_ servo amplifier. Refer to section 11.7.2 for details. ●When using MR Configurator (MRZJW3-SETUP161E) with an operating system of Windows Vista®, Windows® 7, and Windows® 8, refer to section 11.7.3 (2) and (3).

MR Configurator (MRZJW3-SETUP161E) uses the communication function of the servo amplifier to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

11.7.1 Specifications

Item	Description
Communication signal	RS-232C
Baud rate [bps]	57600/38400/19200/9600
Monitor	Batch display, high speed display, graph display (Minimum resolution changes with the processing speed of the personal computer.)
Alarm	Alarm display, alarm history, alarm occurrence time
Diagnosis	Digital I/O, no motor rotation, total power-on time, software No., servo motor information (Note 1), tuning data, ABS data display, Axis name setting.
Parameter	Parameter setting, turning, change list, detailed information
Test operation function (Note 2)	JOG operation, positioning operation, DO forced output, and program operation
Advanced function (Note 3)	Machine analyzer
File operation	Data read, save, print
Others	Automatic demo, help display

Note 1. The HG series servo motor information will not be displayed.
2. The motor-less operation using MR Configurator is not available. To use motor-less operation, set "_ 1 _ _" in [Pr. 24]. (Refer to section 4.5.2.)
3. Machine simulation and gain search functions are not available.

11.7.2 Additional instructions

Item	Description	Display	Restrictions	
			MR-J4-_B_-RJ020	MR-J2S-_B_
Monitor	Batch display	Batch monitor display	Regardless of the [Pr. 7] setting, the display of the cumulative command pulses and command pulse frequency is as follows. ・When the servo motor rotation direction is forward rotation (CCW), the + sign is indicated. ・When the servo motor rotation direction is reverse rotation (CW), the - sign is indicated.	[Pr. 7] setting affects cumulative command pulses and command pulse frequency, and the display is as follows. When "0" is set in [Pr. 7]. ・When the servo motor rotation direction is forward (CCW) due to increase in the positioning address, the + sign is indicated. ・When the servo motor rotation direction is reverse (CW) due to decrease in the positioning address, the - sign is indicated. When "1" is set in [Pr. 7]. ・When the servo motor rotation direction is reverse (CW) due to increase in the positioning address, the + sign is indicated. ・When the servo motor rotation direction is forward (CCW) due to decrease in the positioning address, the - sign is indicated.
	High speed display	High speed monitor display		
Alarm	At alarm occurrence	Data batch display at alarm occurrence		
Test operation	Positioning operation	Positioning operation	Regardless of the [Pr. 7] setting, the operation is as follows. ・Click the "Forward" button changes the servo motor rotation direction to forward (CCW). ・Click the "Reverse" button changes the servo motor rotation direction to reverse (CW).	MR-J2S-700B or less The function operates as follows by the [Pr. 7] setting. When "0" is set in [Pr. 7]. ・Click the "Forward" button changes the servo motor rotation direction to forward (CCW). ・Click the "Reverse" button changes the servo motor rotation direction to reverse (CW). When "1" is set in [Pr. 7]. ・Click the "Forward" button changes the servo motor rotation direction to reverse (CW). ・Click the "Reverse" button changes the servo motor rotation direction to forward (CCW).
	DO forced output	DO forced output	MR-J4-11KB-RJ020 or more/MR-J4-11KB4-RJ020 or more To forcibly output the output signal CN3-13 pin, turn on/off the CON2-3 pin of the DO forced output screen. To forcibly output the output signal CN3-15 pin, turn on/off the CON2-4 pin of the DO forced output screen.	MR-J2S-11KB or more/MR-J2S-11KB4 or more To forcibly output the output signal CON2-3 pin, turn on/off the CON2-3 pin of the DO forced output screen. To forcibly output the output signal CON2-4 pin, turn on/off the CON2-4 pin of the DO forced output screen.
Diagnosis	DI/DO display	DI/DO batch display	MR-J4-11KB-RJ020 or more/MR-J4-11KB4-RJ020 or more The CON2-2 pin of the DI/DO batch display screen displays the status of the input signal CN3-20 pin. The CON2-3 pin of the DI/DO batch display screen displays the status of the output signal CN3-13 pin. The CON2-4 pin of the DI/DO batch display screen displays the status of the output signal CN3-15 pin.	MR-J2S-11KB or more/MR-J2S-11KB4 or more The CON2-2 pin of the DI/DO batch display screen displays the status of the input signal CN2-2 pin. The CON2-3 pin of the DI/DO batch display screen displays the status of the output signal CN2-3 pin. The CON2-4 pin of the DI/DO batch display screen displays the status of the output signal CN2-4 pin.

11.7.3 System requirements

(1) Components

To use MR Configurator (MRZJW3-SETUP161E), the following components are required in addition to the servo amplifier and servo motor.

Model	Description
(Note) Personal computer	IBM PC/AT compatible where the English version of Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional Windows® XP Professional, Windows® XP Home Edition, Windows Vista® Home Basic, Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise, Windows® 7 Starter, Windows® 7 Home Premium, Windows® 7 Professional, Windows® 7 Ultimate, Windows® 7 Enterprise, Windows® 8 Enterprise, Windows® 8 Pro, Windows® 8 operates Processor: Pentium® 133 MHz or more (Windows® 95, Windows® 98, Windows NT® Workstation 4.0, Windows®2000 Professional) Pentium® 150 MHz or more (Windows® Me) Pentium® 300 MHz or more (Windows® XP Professional, Windows® XP Home Edition) Memory: 16 MB or more (Windows® 95), 24 MB or more (Windows®98) 32 MB or more (Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional) 128 MB or more (Windows® XP Professional, Windows® XP Home Edition) Free hard disk space: 60 MB or more Serial port used
OS	Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional, Windows® XP Professional, Windows® XP Home Edition, Windows Vista® Home Basic, Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise, Windows® 7 Starter, Windows® 7 Home Premium, Windows® 7 Professional, Windows® 7 Ultimate, Windows® 7 Enterprise, Windows® 8 Enterprise, Windows® 8 Pro, Windows® 8 (English version)
Display	With 800 × 600 or more resolution and a high color (16 bit) display. Connectable with the above personal computer.
Keyboard	Connectable with the above personal computer.
Mouse	Connectable with the above personal computer. Do not use a serial mouse.
Printer	Connectable with the above personal computer.
Communication cable	MR-CPCATCBL3M and MR-J4T20CH00

Note. On some personal computers, MR Configurator may not run properly.

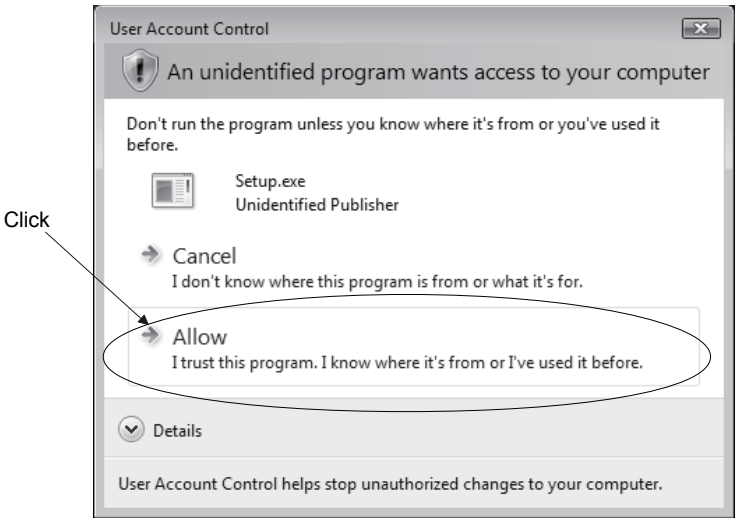
(2) Warnings for installation and startup

POINT
●For installation and startup of MR Configurator (MRZJW3-SETUP161E), log in as a user having Administrator authority (for computer control).

The security functions of Windows Vista®, Windows® 7, and Windows® 8 are greatly enhanced compared to the conventional operating system.
Therefore, when you use MR Configurator (MRZJW3-SETUP161E) with an operating system of Windows Vista®, Windows® 7, and Windows® 8, a warning window will be displayed at the time of installation and startup for MR Configurator. Even if the warning window is displayed, MR Configurator will operate properly. For details of warning windows, refer to the following.

(a) For Windows Vista®

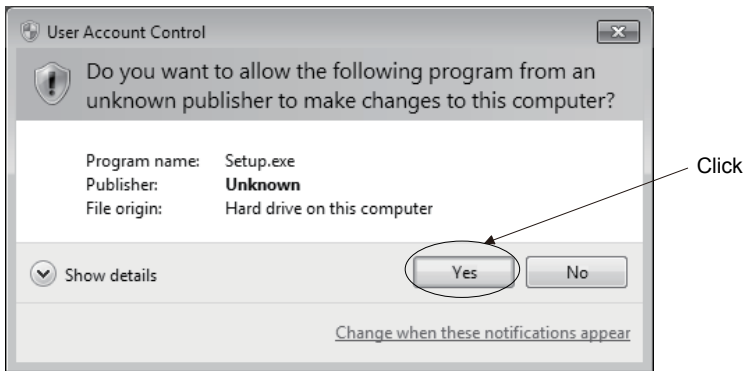
On installation, the following "User Account Control" window is displayed. In this case, click "Allow". After that, installation will start normally.


Click
User Account Control
An unidentified program wants access to your computer
Don't run the program unless you know where it's from or you've used it before.
Setup.exe
Unidentified Publisher
Cancel
I don't know where this program is from or what it's for.
Allow
I trust this program. I know where it's from or I've used it before.
Details
User Account Control helps stop unauthorized changes to your computer.

When you start MR Configurator, The "User Account Control" window is displayed in the same way as with installation. In this case, click "Allow". After that, MR Configurator will start normally.

(b) For Windows® 7 and Windows® 8

On installation, the following "User Account Control" window is displayed. In this case, click "Yes". After that, installation will start normally.


User Account Control
Do you want to allow the following program from an unknown publisher to make changes to this computer?
Program name: Setup.exe
Publisher: Unknown
File origin: Hard drive on this computer
Show details
Yes
No
Change when these notifications appear
Click

When you start MR Configurator, The same "User Account Control" window is displayed in the same way as with installation. In this case, click "Yes". After that, MR Configurator will start normally.

(3) Help

POINT
●We checked that the Windows Help program (WinHlp32.exe) operates normally with the MR Configurator (MRZJW3-SETUP161E) version F1.

Installing the Windows Help program (WinHlp32.exe) enables you to use Windows Help. Download the Windows Help program (WinHlp32.exe) from the following address.

(a) Windows Vista®

- Web address for download (As of March 2014)
  http://www.microsoft.com/en-us/download/details.aspx?id=5143
- Download file
  Windows6.0-KB917607-x86.msu

(b) Windows® 7

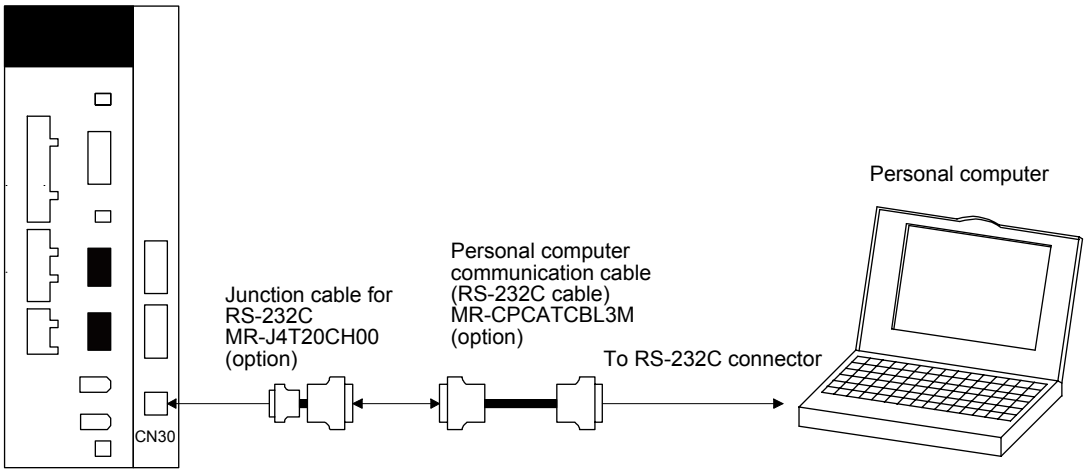
- Web address for download (As of March 2014)
  http://www.microsoft.com/en-us/download/details.aspx?id=91
- Download file
  Windows6.1-KB917607-x86.msu

(c) Windows® 8

- Web address for download (As of March 2014)
  http://www.microsoft.com/en-us/download/details.aspx?id=35449
- Download file
  Windows8-RT-KB917607-x86.msu

When you start help with MR Configurator, "Windows Help and support" window is displayed. From this window, you can also access to the web address for download.

(4) Connection with the servo amplifier


Personal computer
Personal computer communication cable (RS-232C cable) MR-CPCATCBL3M (option)
Junction cable for RS-232C MR-J4T20CH00 (option)
To RS-232C connector
CN30

11.7.4 Precautions for using RS-232C communication function

Note the following to prevent an electric shock and malfunction of the servo amplifier.

(1) Power connection of personal computers
Connect your personal computer with the following procedures.

(a) When you use a personal computer with AC power supply

1) When using a personal computer with a three-core power plug or power plug with grounding wire, use a three-pin socket or ground the grounding wire.

2) When your personal computer has two-core plug and has no grounding wire, connect the personal computer to the servo amplifier with the following procedures.

a) Disconnect the power plug of the personal computer from an AC power socket.

b) Check that the power plug was disconnected and connect the device to the servo amplifier.

c) Connect the power plug of the personal computer to the AC power socket.

(b) When you use a personal computer with battery
You can use as it is.

(2) Connection with other devices using servo amplifier communication function
When the servo amplifier is charged with electricity due to connection with a personal computer and the charged servo amplifier is connected with other devices, the servo amplifier or the connected devices may malfunction. Connect the servo amplifier and other devices with the following procedures.

(a) Shut off the power of the device for connecting with the servo amplifier.

(b) Shut off the power of the servo amplifier which was connected with the personal computer and check the charge lamp is off.

(c) Connect the device with the servo amplifier.

(d) Turn on the power of the servo amplifier and the device.

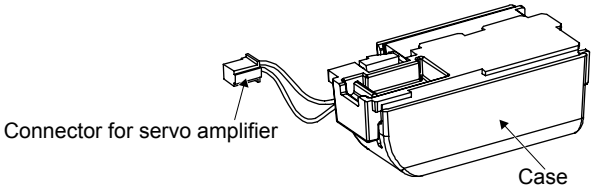
11.8 Battery

POINT
●Refer to appendix 3 and 4 for battery transportation and the new EU Battery Directive. ●The MR-BAT6V1BJ battery for junction battery cable is only for the HG series servo motors.

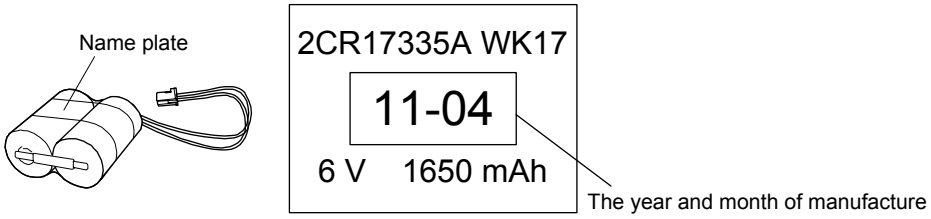
This battery is used to construct an absolute position detection system. Refer to chapter 12 for details.

11.8.1 MR-BAT6V1SET battery

(1) Parts identification

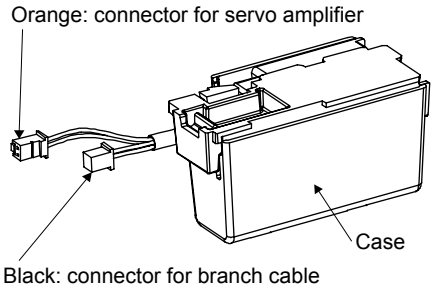


(2) Year and month of manufacture of battery
The year and month of manufacture of MR-BAT6V1 battery have been described to the rating plate put on a MR-BAT6V1 battery built-in MR-BAT6V1SET battery.



11.8.2 MR-BAT6V1BJ battery for junction battery cable

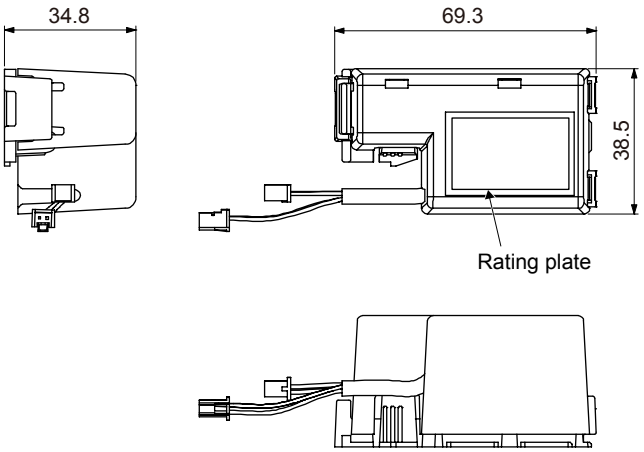
(1) Parts identification



(2) Year and month of manufacture of battery
Production year and month are indicated in a serial number (SERIAL) on the rating plate. The second digit from left in the number indicates the first digit of the dominical year, the third digit from left indicates a month (Oct: X, Nov: Y, Dec.: Z). For November 2013, the serial is like, "SERIAL: _ 3Y _ _ _ _ _ _".

(3) Dimensions

[Unit: mm]

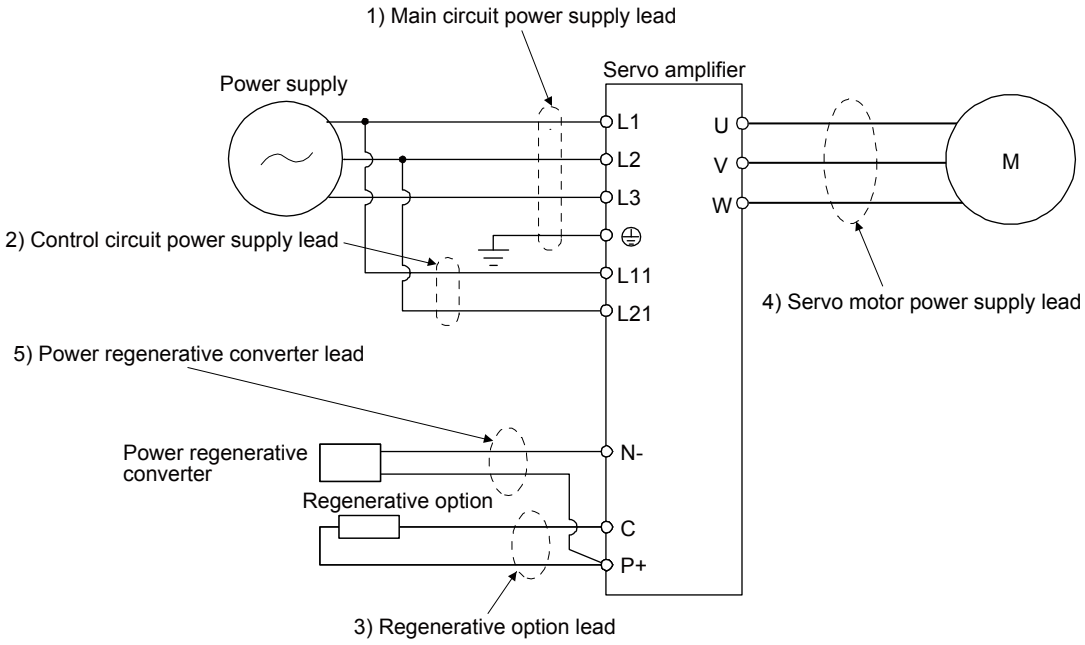


Mass: 66 [g]

11.9 Selection example of wires

POINT
●To comply with the IEC/EN/UL/CSA standard, use the wires shown in appendix 5 for wiring. To comply with other standards, use a wire that is complied with each standard. ●The wire size selection conditions are as follows. Construction condition: Single wire set in the air Wiring length: 30 m or less

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



(1) Example of selecting the wire sizes

Use the 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire) for wiring. The following shows the wire size selection example.

(a) 200 V class

Table 11.1 Wire size selection example (HIV wire)

Servo amplifier	Wire [mm^2] (Note 1)			
	1) L1/L2/L3/⏚	2) L11/L21	3) P+/C	4) U/V/W/⏚ (Note 3)
MR-J4-10B-RJ020	2 (AWG 14)	1.25 to 2 (AWG 16 to 14) (Note 4)	2 (AWG 14)	AWG 18 to 14 (Note 4)
MR-J4-20B-RJ020				
MR-J4-40B-RJ020				
MR-J4-60B-RJ020				
MR-J4-70B-RJ020				
MR-J4-100B-RJ020				
MR-J4-200B-RJ020				AWG 16 to 10
MR-J4-350B-RJ020	3.5 (AWG 12)			
MR-J4-500B-RJ020 (Note 2)	5.5 (AWG 10): a	1.25 (AWG 16): a 2 (AWG 14): d (Note 4)	2 (AWG 14): c	2 (AWG 14): c 3.5 (AWG 12): a 5.5 (AWG 10): a
MR-J4-700B-RJ020 (Note 2)	8 (AWG 8): b			2 (AWG 14): c 3.5 (AWG 12): a 5.5 (AWG 10): a 8 (AWG 8): b
MR-J4-11KB-RJ020 (Note 2)	14 (AWG 6): f	1.25 (AWG 16): c 2 (AWG 14): c	3.5 (AWG 12): g	14 (AWG 6): f 8 (AWG 8): k
MR-J4-15KB-RJ020 (Note 2)	22 (AWG 4): h		5.5 (AWG 10): g	22 (AWG 4): h
MR-J4-22KB-RJ020 (Note 2)	38 (AWG 2): i		5.5 (AWG 10): j	38 (AWG 2): i

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.

2. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.

3. The wire size shows applicable size of the servo amplifier connector and terminal block. For wires connecting to the servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".

4. Be sure to use the size of 2 mm^2 when corresponding to the IEC/EN/UL/CSA standard.

Use wires (5)) of the following sizes with the power regenerative converter (FR-RC).

Model	Wire [mm^2]
FR-RC-15K	14 (AWG 6)
FR-RC-30K	14 (AWG 6)
FR-RC-55K	22 (AWG 4)

(b) 400 V class

Table 11.2 Wire size selection example (HIV wire)

Servo amplifier	Wire [mm^2] (Note 1)			
	1) L1/L2/L3/⏚	2) L11/L21	3) P+/C	4) U/V/W/⏚ (Note 3)
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020	2 (AWG 14)	1.25 to 2 (AWG 16 to 14) (Note 4)	2 (AWG 14)	AWG 16 to 14
MR-J4-200B4-RJ020				
MR-J4-350B4-RJ020				
MR-J4-500B4-RJ020 (Note 2)	2 (AWG 14): b	1.25 (AWG 16): a 2 (AWG 14): c (Note 4)	2 (AWG 14): b	3.5 (AWG 12): a
MR-J4-700B4-RJ020 (Note 2)	3.5 (AWG 12): a			5.5 (AWG 10): a
MR-J4-11KB4-RJ020 (Note 2)	5.5 (AWG 10): d	1.25 (AWG 16): b 2 (AWG 14): b (Note 4)	2 (AWG 14): f	8 (AWG 8): g
MR-J4-15KB4-RJ020 (Note 2)	8 (AWG 8): g		3.5 (AWG 12): d	
MR-J4-22KB4-RJ020 (Note 2)	14 (AWG 6): i		3.5 (AWG 12): e	14 (AWG 6): i

Note 1. Alphabets in the table indicate crimping tools. For crimp terminals and applicable tools, refer to (2) in this section.
2. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
3. The wire size shows applicable size of the servo amplifier connector and terminal block. For wires connecting to the servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".
4. Be sure to use the size of 2 mm^2 when corresponding to the IEC/EN/UL/CSA standard.

Use wires (5)) of the following sizes with the power regenerative converter (FR-RC-H).

Model	Wire [mm^2]
FR-RC-H15K	14 (AWG6)
FR-RC-H30K	
FR-RC-H55K	

(c) 100 V class

Table 11.3 Wire size selection example (HIV wire)

Servo amplifier	Wire [mm^2]			
	1) L1/L2/⏚	2) L11/L21	3) P+/C	4) U/V/W/⏚ (Note 1)
MR-J4-10B1-RJ020	2 (AWG 14)	1.25 to 2 (AWG 16 to 14) (Note 2)	2 (AWG 14)	AWG 18 to 14 (Note 4)
MR-J4-20B1-RJ020				
MR-J4-40B1-RJ020				

Note 1. The wire size shows applicable size of the servo amplifier connector. For wires connecting to the servo motor, refer to "Servo Motor Instruction Manual (Vol. 3)".
2. Be sure to use the size of 2 mm^2 when corresponding to the IEC/EN/UL/CSA standard.

(2) Selection example of crimp terminals

(a) 200 V class

Symbol	Servo amplifier-side crimp terminals				Manufacturer
	(Note 2) Crimp terminal	Applicable tool			
		Body	Head	Dice	
a	FVD5.5-4	YNT-1210S			JST
b (Note 1)	8-4NS	YHT-8S			
c	FVD2-4	YNT-1614			
d	FVD2-M3				
e	FVD1.25-M3	YNT-2216			
f	FVD14-6	YF-1	YNE-38	DH-122 DH-112	
g	FVD5.5-6	YNT-1210S			
h	FVD22-6	YF-1	YNE-38	DH-123 DH-113	
i	FVD38-8	YF-1	YNE-38	DH-124 DH-114	
j	FVD5.5-8	YNT-1210S			
k	FVD8-6	YF-1 E-4	YNE-38	DH-121 DH-111	

Note 1. Coat the crimping part with an insulation tube.

2. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

(b) 400 V class

Symbol	Servo amplifier-side crimp terminals				Manufacturer
	Crimp terminal (Note)	Applicable tool			
		Body	Head	Dice	
a	FVD5.5-4	YNT-1210S			JST
b	FVD2-4	YNT-1614			
c	FVD2-M3				
d	FVD5.5-6	YNT-1210S			
e	FVD5.5-8	YNT-1210S			
f	FVD2-6	YNT-1614			
g	FVD8-6	YF-1	YNE-38	DH-121 DH-111	
h	FVD8-8				
i	FVD14-8			DH-122 DH-112	

Note. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended ones or equivalent ones.

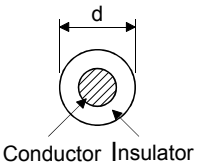
(3) Wires for cables

When fabricating a cable, use the wire models given in the following table or equivalent.

Table 11.4 Wires for option cables

Type	Model	Length [m]	Core size [mm^2]	Number of core	Characteristics of one core			(Note 2) Overall diameter [mm]	Wire model
					Structure [Wires/ mm]	Conductor resistance [Ω/km]	Insulator OD d [mm] (Note 1)		
SSCNET cable	MR-J2HBUS_M MR-J2HBUS_M-A	0.5 to 5	0.08	20 (10 pairs)	7/0.127	222 or less	0.38	6.1	UL20276 AWG#28 10pair (cream)

Note 1. d is as shown below.



2. Standard OD. Max. OD is about 10 greater.

11.10 Molded-case circuit breakers, fuses, magnetic contactors (recommended)

(1) For main circuit power supply

Always use one molded-case circuit breaker and one magnetic contactor with one servo amplifier. When using a fuse instead of the molded-case circuit breaker, use the one having the specifications given in this section.

Servo amplifier	Molded-case circuit breaker (Note 1)			Fuse			Magnetic contactor (Note 2)
	Frame, rated current		Voltage AC [V]	Class	Current [A]	Voltage AC [V]	
	Power factor improving reactor is not used	Power factor improving reactor is used					
MR-J4-10B-RJ020	30 A frame 5 A	30 A frame 5 A	240	T	10	300	S-N10 S-T10
MR-J4-20B-RJ020	30 A frame 5 A	30 A frame 5 A					
MR-J4-40B-RJ020	30 A frame 10 A	30 A frame 5 A			15		
MR-J4-60B-RJ020	30 A frame 15 A	30 A frame 10 A			20		
MR-J4-70B-RJ020	30 A frame 15 A	30 A frame 10 A					
MR-J4-100B-RJ020	30 A frame 15 A	30 A frame 10 A					
MR-J4-200B-RJ020	30 A frame 20 A	30 A frame 20 A			40		S-N20 (Note 3) S-T21
MR-J4-350B-RJ020	30 A frame 30 A	30 A frame 30 A			70		S-N20 S-T21
MR-J4-500B-RJ020	50 A frame 50 A	50 A frame 50 A			125		S-N35
MR-J4-700B-RJ020	100 A frame 75 A	60 A frame 60 A			150		S-N50
MR-J4-11KB-RJ020	100 A frame 100 A	100 A frame 100 A			200		
MR-J4-15KB-RJ020	125 A frame 125 A	125 A frame 125 A			250		S-N65
MR-J4-22KB-RJ020	225 A frame 175 A	225 A frame 175 A			350		S-N95
MR-J4-60B4-RJ020	30 A frame 5 A	30 A frame 5 A	480	T	10	600	S-N10 S-T10
MR-J4-100B4-RJ020	30 A frame 10 A	30 A frame 5 A			15		
MR-J4-200B4-RJ020	30 A frame 15 A	30 A frame 10 A			25		
MR-J4-350B4-RJ020	30 A frame 20 A	30 A frame 15 A			35		S-N20 (Note 3) S-T21
MR-J4-500B4-RJ020	30 A frame 20 A	30 A frame 20 A			50		
MR-J4-700B4-RJ020	30 A frame 30 A	30 A frame 30 A			65		S-N20 S-T21
MR-J4-11KB4-RJ020	50 A frame 50 A	50 A frame 50 A			100		S-N25
MR-J4-15KB4-RJ020	60 A frame 60 A	60 A frame 60 A			150		S-N35
MR-J4-22KB4-RJ020	100 A frame 100 A	100 A frame 100 A			175		S-N50
MR-J4-10B1-RJ020	30 A frame 5 A	30 A frame 5 A	240	T	10	300	S-N10 S-T10
MR-J4-20B1-RJ020	30 A frame 10 A	30 A frame 10 A			15		
MR-J4-40B1-RJ020	30 A frame 15 A	30 A frame 10 A			20		

Note 1. When having the servo amplifier comply with the IEC/EN/UL/CSA standard, refer to appendix 5.
2. Use a magnetic contactor with an operation delay time (interval between current being applied to the coil until closure of the contact) of 80 ms or less.
3. S-N18 can be used when an auxiliary contact is not required.

(2) For control circuit

When the wiring for the control circuit power supply (L11, L21) is thinner than that for the main circuit power supply (L1, L2, L3), install an overcurrent protection device (molded-case circuit breaker or fuse) to protect the branch circuit.

Servo amplifier	Molded-case circuit breaker (Note)		Fuse (Class T)		Fuse (Class K5)	
	Frame, rated current	Voltage AC [V]	Current [A]	Voltage AC [V]	Current [A]	Voltage AC [V]
MR-J4-10B-RJ020	30 A frame 5 A	240	1	300	1	250
MR-J4-20B-RJ020						
MR-J4-40B-RJ020						
MR-J4-60B-RJ020						
MR-J4-70B-RJ020						
MR-J4-100B-RJ020						
MR-J4-200B-RJ020						
MR-J4-350B-RJ020						
MR-J4-500B-RJ020						
MR-J4-700B-RJ020						
MR-J4-11KB-RJ020						
MR-J4-15KB-RJ020						
MR-J4-22KB-RJ020						
MR-J4-60B4-RJ020	30 A frame 5 A	480	1	600	1	600
MR-J4-100B4-RJ020						
MR-J4-200B4-RJ020						
MR-J4-350B4-RJ020						
MR-J4-500B4-RJ020						
MR-J4-700B4-RJ020						
MR-J4-11KB4-RJ020						
MR-J4-15KB4-RJ020						
MR-J4-22KB4-RJ020						
MR-J4-10B1-RJ020	30 A frame 5 A	240	1	300	1	250
MR-J4-20B1-RJ020						
MR-J4-40B1-RJ020						

Note. When having the servo amplifier comply with the IEC/EN/UL/CSA standard, refer to appendix 5.

11.11 Power factor improving DC reactor

The following shows the advantages of using the power factor improving DC reactor.

- It improves the power factor by increasing the form factor of the servo amplifier's input current.
- It decreases the power supply capacity.
- The input power factor is improved to about 85%.
- As compared to the power factor improving AC reactor (FR-HAL-(H)), it decreases the loss.

When connecting the power factor improving DC reactor to the servo amplifier, always disconnect the wiring between P3 and P4. If they remain connected, the effect of the power factor improving DC reactor is not produced.

When used, the power factor improving DC reactor generates heat. To release heat, therefore, leave a 10 cm or more clearance at each of the top and bottom, and a 5 cm or more clearance on each side.

(1) 200 V class

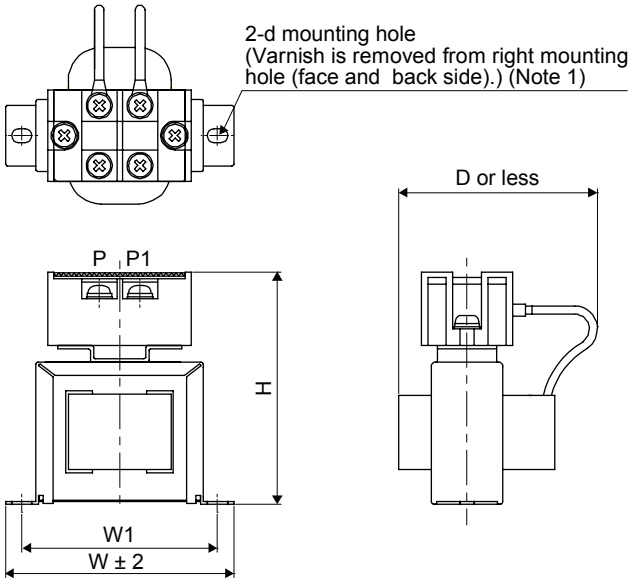


Fig. 11.1

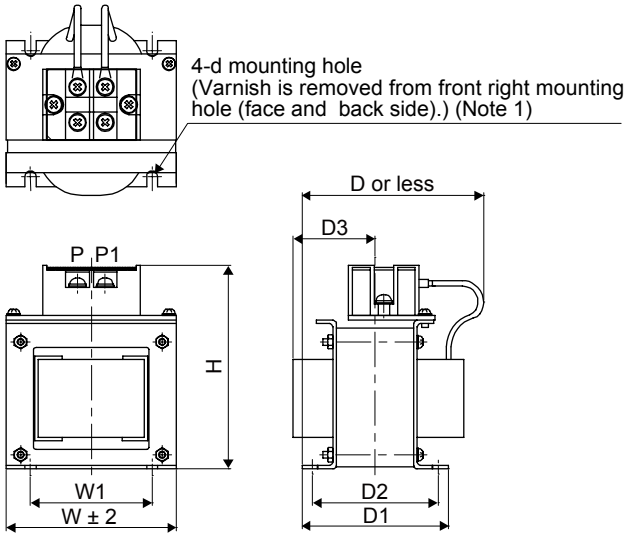


Fig. 11.2

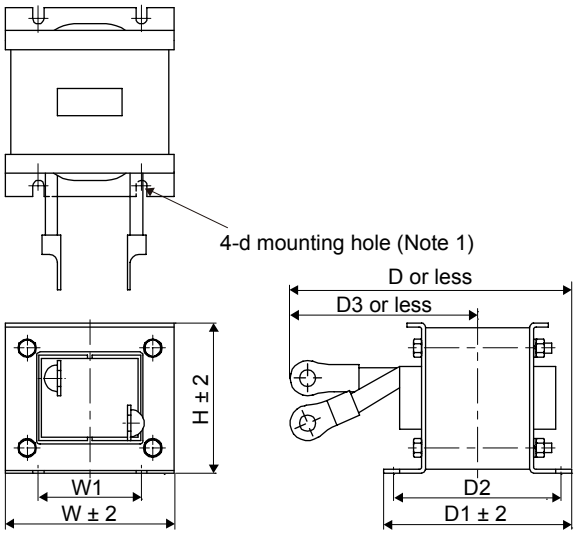
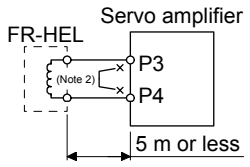


Fig. 11.3



Note 1. Use this for grounding.

2. When using the power factor improving DC reactor, remove the short bar across P3 and P4.

Servo amplifier	Power factor improving DC reactor	Dimensions	Dimensions [mm]								Terminal size	Mass [kg]	Wire [mm^2] (Note 2)
			W	W1	H	D (Note 1)	D1	D2	D3	d			
MR-J4-10B-RJ020 MR-J4-20B-RJ020	FR-HEL-0.4K	Fig. 11.1	70	60	71	61		21		M4	M4	0.4	2 (AWG 14)
MR-J4-40B-RJ020	FR-HEL-0.75K		85	74	81	61		21		M4	M4	0.5	
MR-J4-60B-RJ020 MR-J4-70B-RJ020	FR-HEL-1.5K		85	74	81	70		30		M4	M4	0.8	
MR-J4-100B-RJ020	FR-HEL-2.2K		85	74	81	70		30		M4	M4	0.9	
MR-J4-200B-RJ020	FR-HEL-3.7K	Fig. 11.2	77	55	92	82	66	57	37	M4	M4	1.5	
MR-J4-350B-RJ020	FR-HEL-7.5K		86	60	113	98	81	72	43	M4	M5	2.5	3.5 (AWG 12)
MR-J4-500B-RJ020	FR-HEL-11K		105	64	133	112	92	79	47	M6	M6	3.3	5.5 (AWG 10)
MR-J4-700B-RJ020	FR-HEL-15K		105	64	133	115	97	84	48.5	M6	M6	4.1	8 (AWG 8)
MR-J4-11KB-RJ020	FR-HEL-15K		105	64	133	115	97	84	48.5	M6	M6	4.1	14 (AWG 6)
MR-J4-15KB-RJ020	FR-HEL-22K		105	64	93	175	117	104	115 (Note 1)	M6	M10	5.6	22 (AWG 4)
MR-J4-22KB-RJ020	FR-HEL-30K	Fig. 11.3	114	72	100	200	125	101	135 (Note 1)	M6	M10	7.8	38 (AWG 2)

Note 1. Maximum dimensions. The dimension varies depending on the input/output lines.

2. The wire size selection conditions are as follows.
   Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
   Construction condition: Single wire set in the air

(2) 400 V class

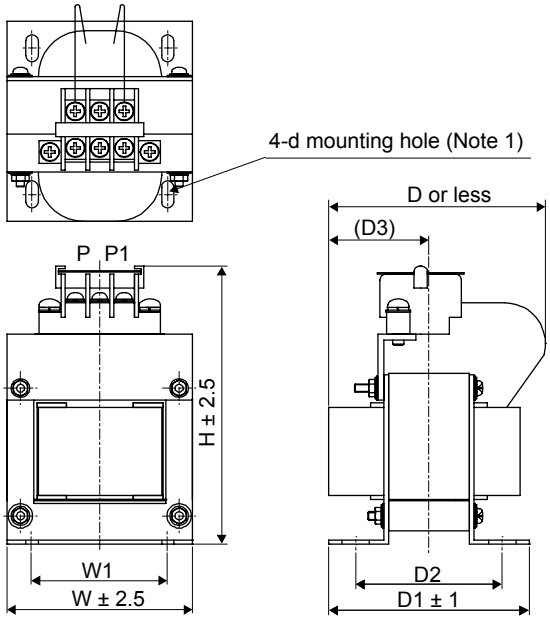


Fig. 11.4

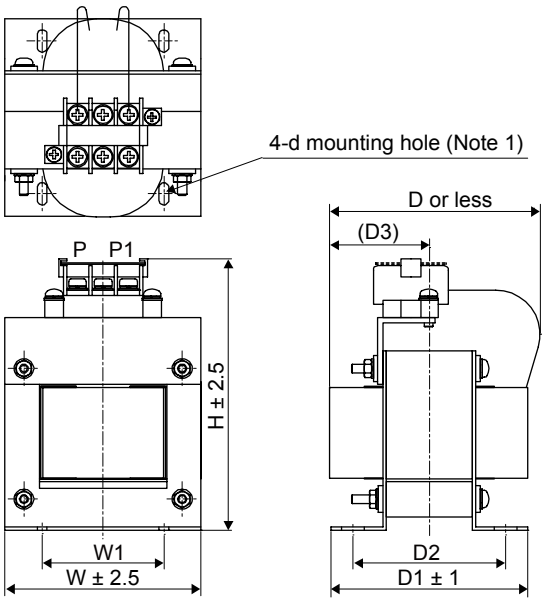
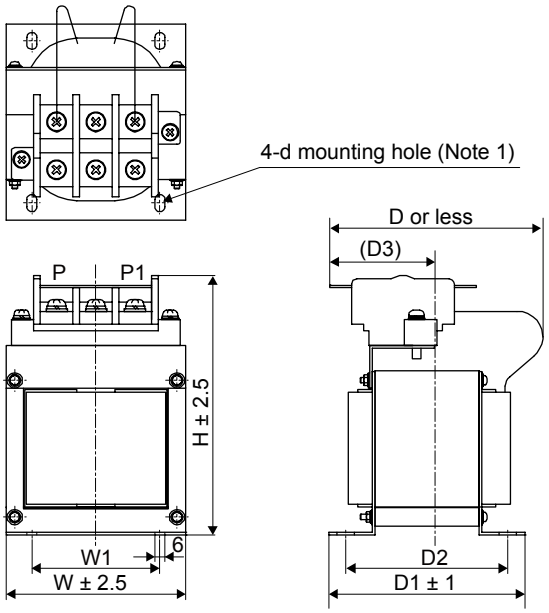


Fig. 11.5



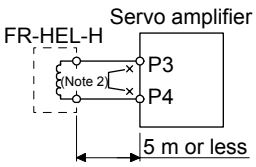


Fig. 11.6

Note 1. Use this for grounding.
2. When using the power factor improving DC reactor, remove the short bar across P3 and P4.

Servo amplifier	Power factor improving DC reactor	Dimensions	Dimensions [mm]								Terminal size	Mass [kg]	Wire [mm^2] (Note)
			W	W1	H	D	D1	D2	D3	d			
MR-J4-60B4-RJ020	FR-HEL-H1.5K	Fig. 11.4	66	50	100	80	74	54	37	M4	M3.5	1.0	2 (AWG 14)
MR-J4-100B4-RJ020	FR-HEL-H2.2K		76	50	110	80	74	54	37	M4	M3.5	1.3	2 (AWG 14)
MR-J4-200B4-RJ020	FR-HEL-H3.7K		86	55	120	95	89	69	45	M4	M4	2.3	2 (AWG 14)
MR-J4-350B4-RJ020	FR-HEL-H7.5K	Fig. 11.5	96	60	128	105	100	80	50	M5	M4	3.5	2 (AWG 14)
MR-J4-500B4-RJ020	FR-HEL-H11K		105	75	137	110	105	85	53	M5	M5	4.5	3.5 (AWG 12)
MR-J4-700B4-RJ020	FR-HEL-H15K	Fig. 11.6	105	75	152	125	115	95	62	M5	M6	5.0	5.5 (AWG 10)
MR-J4-11KB4-RJ020	FR-HEL-H15K		105	75	152	125	115	95	62	M5	M6	5.0	8 (AWG 8)
MR-J4-15KB4-RJ020	FR-HEL-H22K		133	90	178	120	95	75	53	M5	M6	6.0	8 (AWG 8)
MR-J4-22KB4-RJ020	FR-HEL-H30K		133	90	178	120	100	80	56	M5	M6	6.5	14 (AWG 6)

Note. The wire size selection conditions are as follows.
Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Construction condition: Single wire set in the air

11.12 Power factor improving AC reactor

The following shows the advantages of using the power factor improving AC reactor.

- It improves the power factor by increasing the form factor of the servo amplifier's input current.
- It decreases the power supply capacity.
- The input power factor is improved to about 80%.

When using power factor improving reactors for two or more servo amplifiers, be sure to connect a power factor improving reactor to each servo amplifier. If using only one power factor improving reactor, enough improvement effect of phase factor cannot be obtained unless all servo amplifiers are operated.

(1) 200 V/100 V class

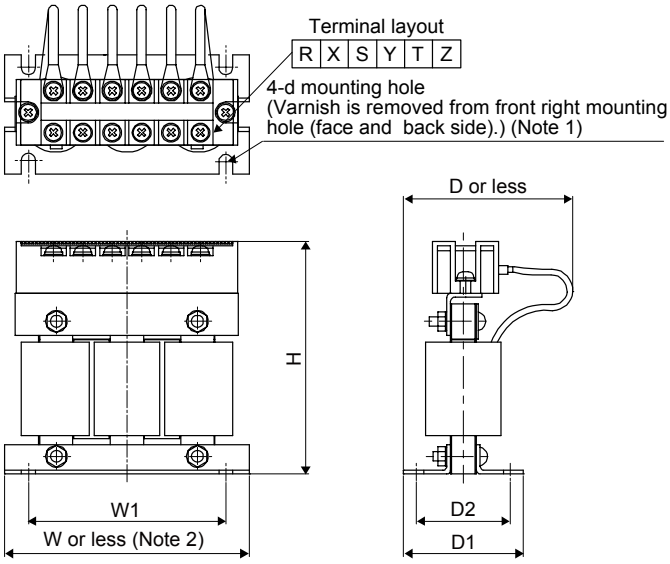
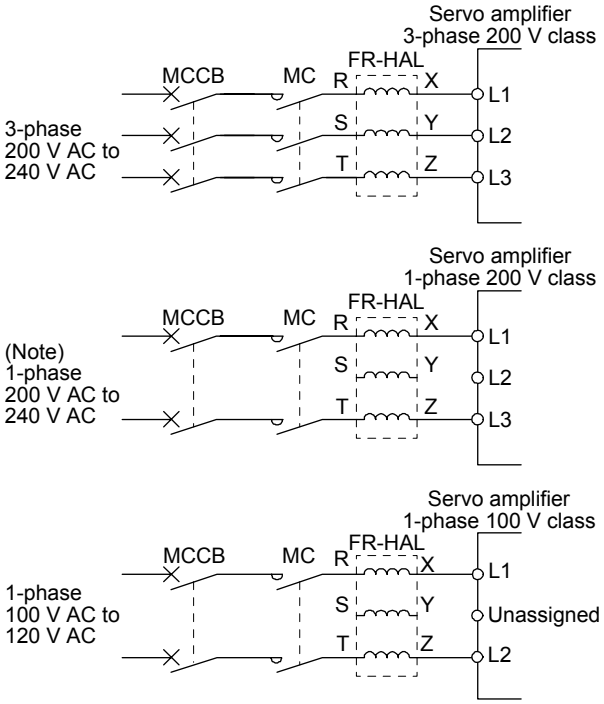


Fig. 11.7



Note 1. Use this for grounding.
2. W ± 2 is applicable for FR-HAL-0.4K to FR-HAL-1.5K.

Note. For 1-phase 200 V AC to 240 V AC, connect the power supply to L1 and L3. Leave L2 open.

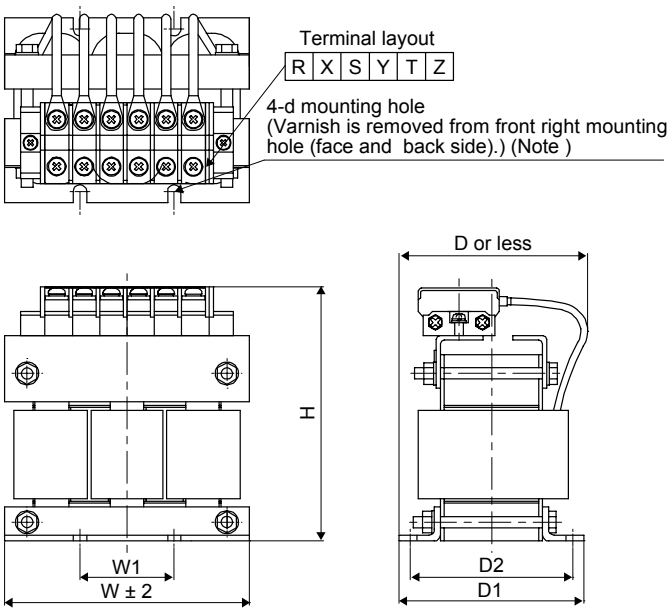


Fig. 11.8

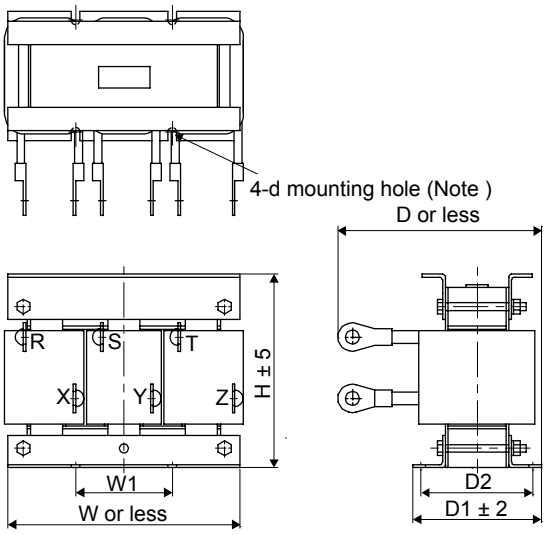


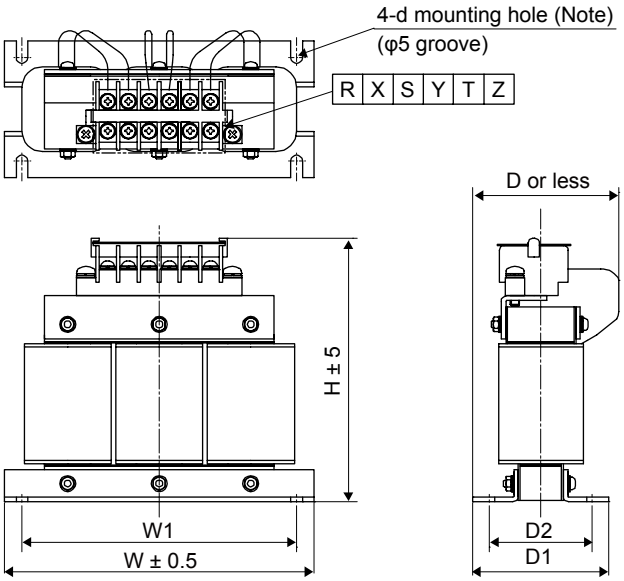
Fig. 11.9

Note. Use this for grounding.

Servo amplifier	Power factor improving AC reactor	Dimensions	Dimensions [mm]							Terminal size	Mass [kg]
			W	W1	H	D (Note)	D1	D2	d		
MR-J4-10B-RJ020 MR-J4-20B-RJ020 MR-J4-10B1-RJ020	FR-HAL-0.4K	Fig. 11.7	104	84	99	72	51	40	M5	M4	0.6
MR-J4-40B-RJ020 MR-J4-20B1-RJ020	FR-HAL-0.75K		104	84	99	74	56	44	M5	M4	0.8
MR-J4-60B-RJ020 MR-J4-70B-RJ020 MR-J4-40B1-RJ020	FR-HAL-1.5K		104	84	99	77	61	50	M5	M4	1.1
MR-J4-100B-RJ020	FR-HAL-2.2K		115 (Note)	40	115	77	71	57	M6	M4	1.5
MR-J4-200B-RJ020	FR-HAL-3.7K		115 (Note)	40	115	83	81	67	M6	M4	2.2
MR-J4-350B-RJ020	FR-HAL-7.5K	Fig. 11.8	130	50	135	100	98	86	M6	M5	4.2
MR-J4-500B-RJ020	FR-HAL-11K		160	75	164	111	109	92	M6	M6	5.2
MR-J4-700B-RJ020	FR-HAL-15K		160	75	167	126	124	107	M6	M6	7.0
MR-J4-11KB-RJ020	FR-HAL-15K		160	75	167	126	124	107	M6	M6	7.0
MR-J4-15KB-RJ020	FR-HAL-22K		185 (Note)	75	150	158	100	87	M6	M8	9.0
MR-J4-22KB-RJ020	FR-HAL-30K	Fig. 11.9	185 (Note)	75	150	168	100	87	M6	M10	9.7

Note. Maximum dimensions. The dimension varies depending on the input/output lines.

(2) 400 V class



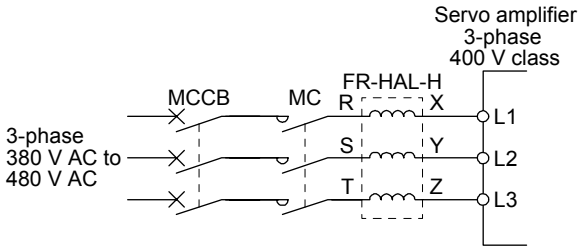


Fig. 11.10

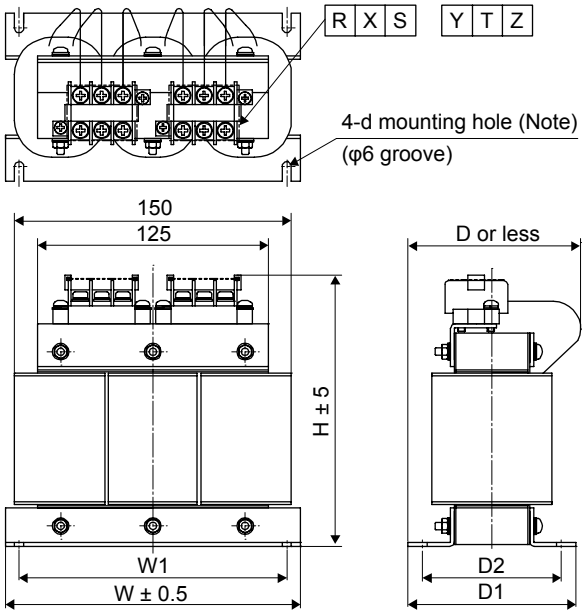


Fig. 11.11

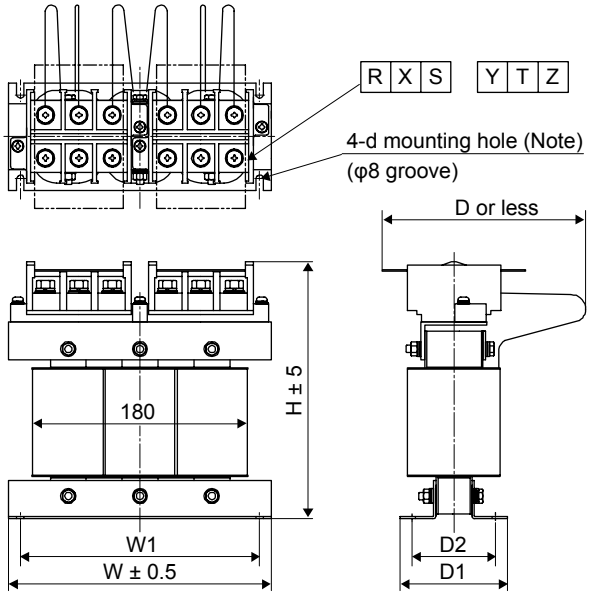


Fig. 11.12

Note. Use this for grounding.

Servo amplifier	Power factor improving AC reactor	Dimensions	Dimensions [mm]							Terminal size	Mass [kg]
			W	W1	H	D (Note)	D1	D2	d		
MR-J4-60B4-RJ020	FR-HAL-H1.5K	Fig. 11.10	135	120	115	59	59.6	45	M4	M3.5	1.5
MR-J4-100B4-RJ020	FR-HAL-H2.2K		135	120	115	59	59.6	45	M4	M3.5	1.5
MR-J4-200B4-RJ020	FR-HAL-H3.7K		135	120	115	69	70.6	57	M4	M3.5	2.5
MR-J4-350B4-RJ020	FR-HAL-H7.5K	Fig. 11.11	160	145	142	91	91	75	M4	M4	5.0
MR-J4-500B4-RJ020	FR-HAL-H11K		160	145	146	91	91	75	M4	M5	6.0
MR-J4-700B4-RJ020 MR-J4-11KB4-RJ020	FR-HAL-H15K		220	200	195	105	90	70	M5	M5	9.0
MR-J4-15KB4-RJ020	FR-HAL-H22K	Fig. 11.12	220	200	215	170	90	70	M5	M8	9.5
MR-J4-22KB4-RJ020	FR-HAL-H30K		220	200	215	170	96	75	M5	M8	11

Note. Maximum dimensions. The dimension varies depending on the input/output lines.

11.13 Relay (recommended)

The following relays should be used with the interfaces.

Interface	Selection example
Digital input (interface DI-1) Relay used for digital input command signals	To prevent defective contacts, use a relay for small signal (twin contacts). (Ex.) Omron: type G2A, type MY
Digital output (interface DO-1) Relay used for digital output signals	Small relay with 12 V DC or 24 V DC of rated current 40 mA or less (Ex.) Omron: type MY

11.14 Noise reduction techniques

Noises are classified into external noises which enter the servo amplifier to cause it to malfunction and those radiated by the servo amplifier to cause peripheral equipment to malfunction. Since the servo amplifier is an electronic device which handles small signals, the following general noise reduction techniques are required. Also, the servo amplifier can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral equipment malfunction due to noises produced by the servo amplifier, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques

(a) General reduction techniques

- Avoid bundling power lines (input/output) and signal cables together or running them in parallel to each other. Separate the power lines from the signal cables.
- Use a shielded twisted pair cable for connection with the encoder and for control signal transmission, and connect the external conductor of the cable to the SD terminal.
- Ground the servo amplifier, servo motor, etc. together at one point. (Refer to section 3.9.)

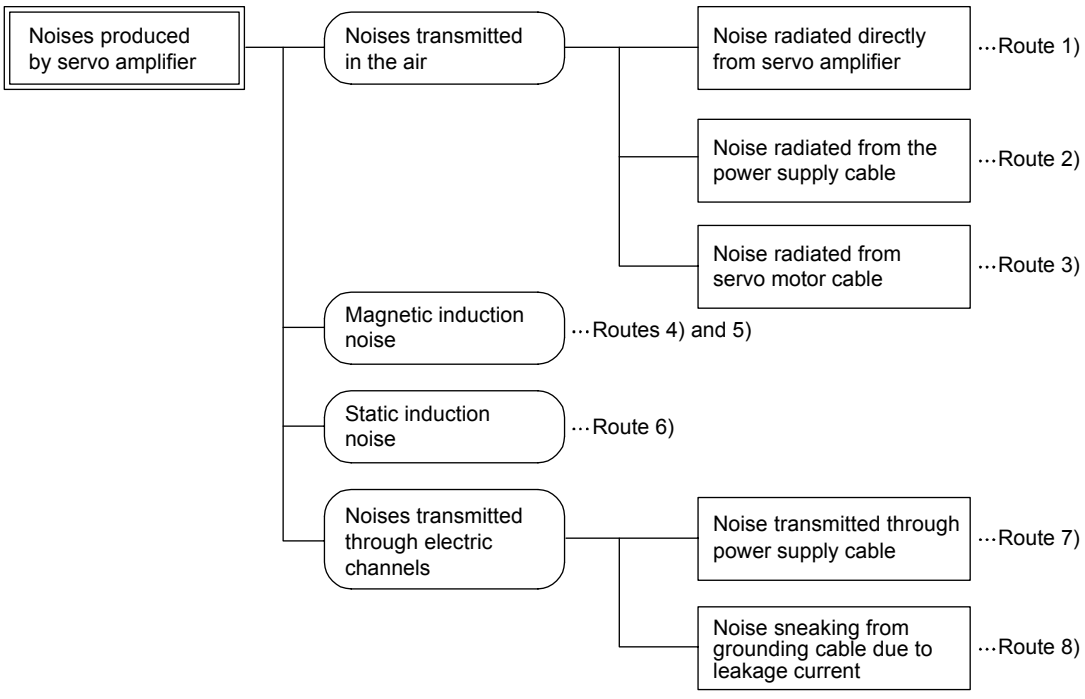
(b) Reduction techniques for external noises that cause the servo amplifier to malfunction

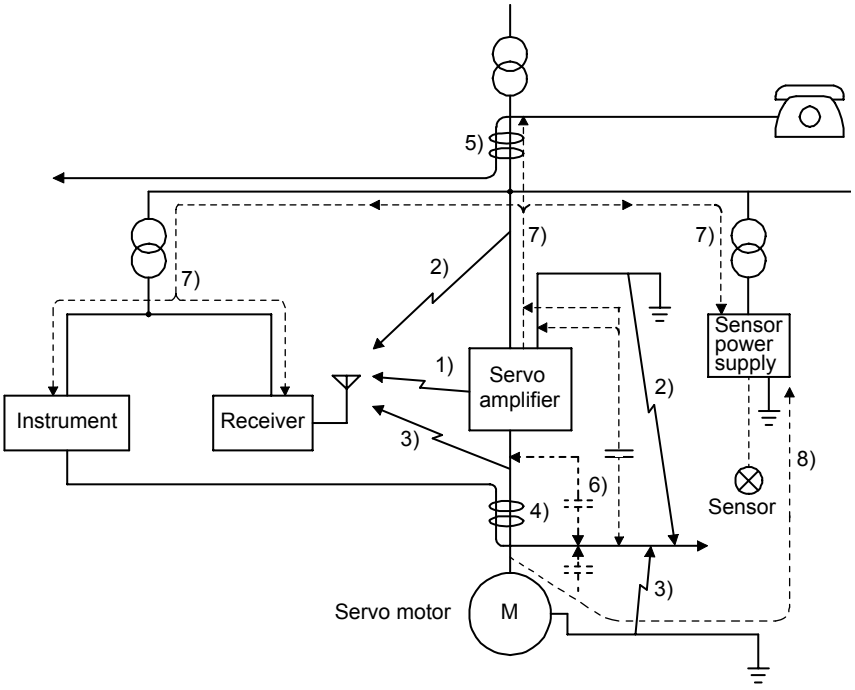
If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the servo amplifier and the servo amplifier may malfunction, the following countermeasures are required.

- Provide surge killers on the noise sources to suppress noises.
- Attach data line filters to the signal cables.
- Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.
- Although a surge absorber is built into the servo amplifier, to protect the servo amplifier and other equipment against large exogenous noise and lightning surge, attaching a varistor to the power input section of the equipment is recommended.

(c) Techniques for noises radiated by the servo amplifier that cause peripheral equipment to malfunction

Noises produced by the servo amplifier are classified into those radiated from the cables connected to the servo amplifier and its main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral equipment located near the main circuit cables, and those transmitted through the power supply cables.


Noises produced by servo amplifier
Noises transmitted in the air
Noise radiated directly from servo amplifier
…Route 1)
Noise radiated from the power supply cable
…Route 2)
Noise radiated from servo motor cable
…Route 3)
Magnetic induction noise
…Routes 4) and 5)
Static induction noise
…Route 6)
Noises transmitted through electric channels
Noise transmitted through power supply cable
…Route 7)
Noise sneaking from grounding cable due to leakage current
…Route 8)



Noise transmission route	Suppression techniques
1) 2) 3)	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a cabinet together with the servo amplifier or run near the servo amplifier, such devices may malfunction due to noises transmitted through the air. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid wiring the power lines (input/output lines of the servo amplifier) and signal lines side by side or bundling them together. 4. Insert a line noise filter to the I/O cables or a radio noise filter on the input line. 5. Use shielded wires for the signal and power lines, or put the lines in separate metal conduits.
4) 5) 6)	When the power lines and the signal lines are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid wiring the power lines (input/output lines of the servo amplifier) and signal lines side by side or bundling them together. 4. Use shielded wires for the signal and power lines, or put the lines in separate metal conduits.
7)	When the power supply of peripheral equipment is connected to the power supply of the servo amplifier system, noises produced by the servo amplifier may be transmitted back through the power supply cable and the devices may malfunction.The following techniques are required. 1. Install the radio noise filter (FR-BIF-(H)) on the power lines (Input lines) of the servo amplifier. 2. Install the line noise filter (FR-BSF01/FR-BLF) on the power lines of the servo amplifier.
8)	When the cables of peripheral equipment are connected to the servo amplifier to make a closed loop circuit, leakage current may flow to malfunction the peripheral equipment. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

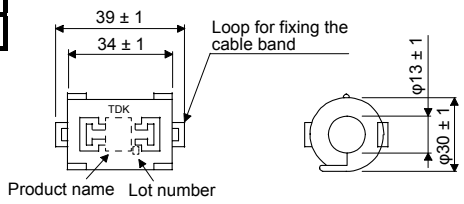
(2) Noise reduction techniques

(a) Data line filter (recommended)

Noise can be prevented by installing a data line filter onto the encoder cable, etc.
For example, ZCAT3035-1330 by TDK, ESD-SR-250 by NEC TOKIN, GRFC-13 by Kitagawa Industries, and E04SRM563218 by SEIWA ELECTRIC are available as data line filters.
As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below. This impedances are reference values and not guaranteed values.

Impedance [Ω]	
10 MHz to 100 MHz	100 MHz to 500 MHz
80	150

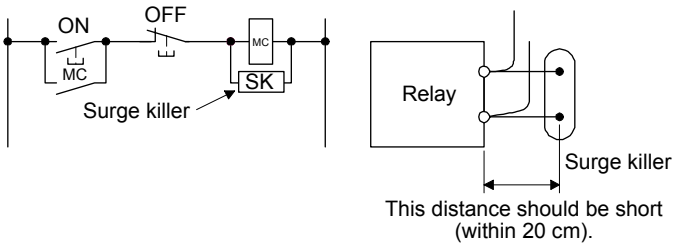
[Unit: mm]



Outline drawing (ZCAT3035-1330)

(b) Surge killer (recommended)

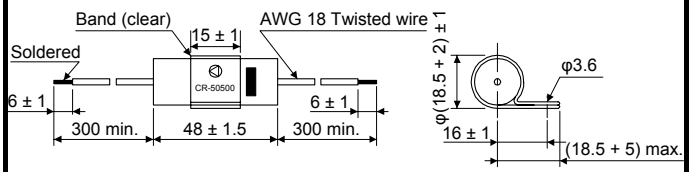
Use of a surge killer is recommended for AC relay, magnetic contactor or the like near the servo amplifier. Use the following surge killer or equivalent.



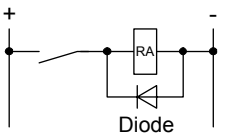
(Ex.) CR-50500 (Okaya Electric Industries)

Rated voltage AC [V]	C [μF ± 20%]	R [Ω ± 30%]	Test voltage
250	0.5	50 (1/2W)	Between terminals: 625 V AC, 50/60 Hz 60 s Between terminal and case: 2000 V AC 50/60 Hz 60 s

Dimensions [Unit: mm]



Note that a diode should be installed to a DC relay or the like.
Maximum voltage: not less than four times the drive voltage of the relay or the like
Maximum current: not less than two times the drive current of the relay or the like



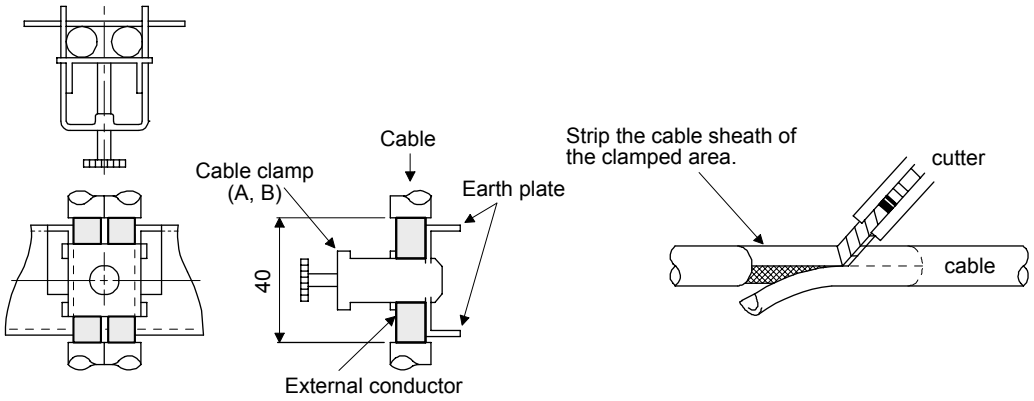
(c) Cable clamp fitting AERSBAN-_SET

Generally, the grounding of the shielded wire may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an grounding plate as shown below.

Install the grounding plate near the servo amplifier for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the grounding plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The cable clamp comes as a set with the grounding plate.

[Unit: mm]

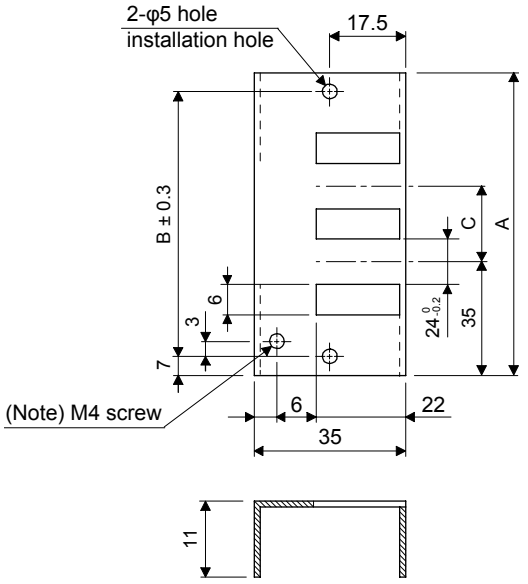


Clamp section diagram

・Dimensions

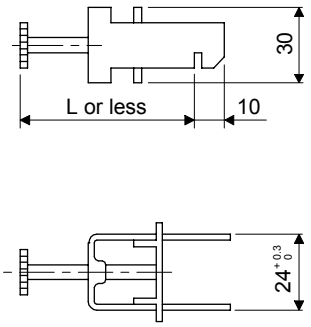
[Unit: mm]

Earth plate



[Unit: mm]

Clamp section diagram



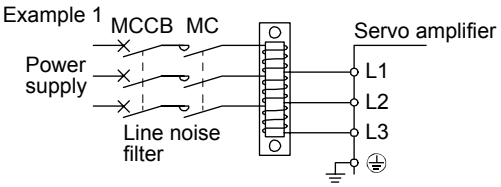
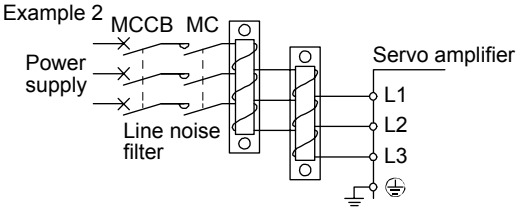
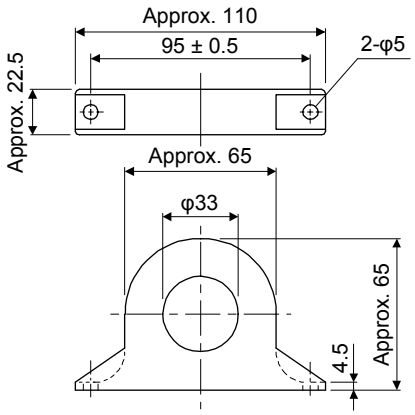
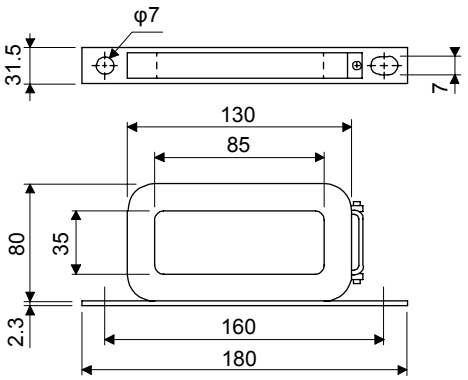
Note. Screw hole for grounding. Connect it to the grounding plate of the cabinet.

Model	A	B	C	Accessory fittings
AERSBAN-DSET	100	86	30	Clamp A: 2pcs.
AERSBAN-ESET	70	56		Clamp B: 1pc.

Clamp fitting	L
A	70
B	45

(d) Line noise filter (FR-BSF01/FR-BLF)

This filter is effective in suppressing noises radiated from the power supply side and output side of the servo amplifier and also in suppressing high-frequency leakage current (0-phase current). It especially affects the noises between 0.5 MHz and 5 MHz band.

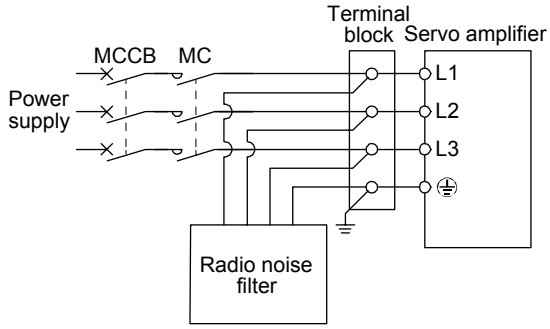
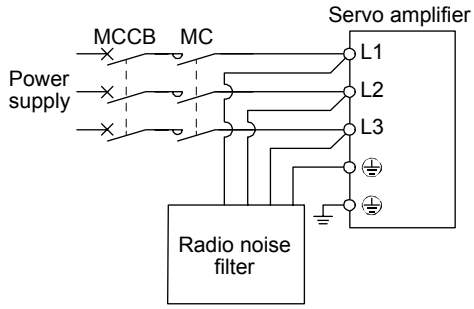
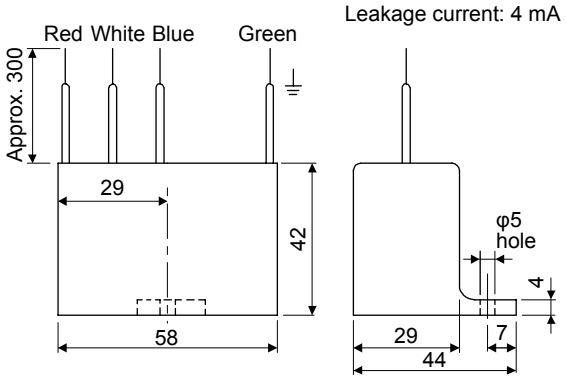
Connection diagram	Dimensions [Unit: mm]
Use the line noise filters for lines of the main power supply (L1, L2, and L3) and of the servo motor power (U, V, and W). Pass each of the wires through the line noise filter an equal number of times in the same direction. For the main power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the servo motor power lines, passes must be four times or less. Do not pass the grounding wire through the filter. or the effect of the filter will drop. Wind the wires by passing through the filter to satisfy the required number of passes as shown in Example 1. If the wires are too thick to wind, use two or more filters to have the required number of passes as shown in Example 2. Place the line noise filters as close to the servo amplifier as possible for their best performance. Noise-reducing effect will be enhanced. Example 1  (Number of passes: 4) Example 2  Two filters are used (Total number of passes: 4)	FR-BSF01 (for wire size 3.5 mm^2 (AWG 12) or less)  FR-BLF (for wire size 5.5 mm^2 (AWG 10) or more) 

(e) Radio noise filter (FR-BIF-(H))

This filter is effective in suppressing noises radiated from the power supply side of the servo amplifier especially in 10 MHz and lower radio frequency bands. The (FR-BIF-(H)) is designed for the input only.

200 V/100 V class: FR-BIF

400 V class: FR-BIF-H

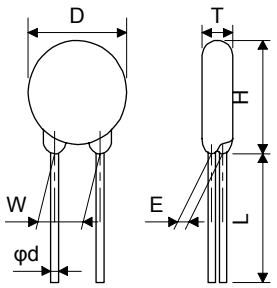
Connection diagram	Dimensions [Unit: mm]
Make the connection cables as short as possible. Grounding is always required. When using the FR-BIF with a single-phase power supply, always insulate the lead wires that are not used for wiring. • MR-J4-350B-RJ020 or less/MR-J4-350B4-RJ020 or less/ MR-J4-40B1-RJ020 or less  • MR-J4-500B-RJ020 or more/MR-J4-500B4-RJ020 or more 	

(f) Varistor for input power supply (recommended)

Varistors are effective to prevent exogenous noise and lightning surge from entering the servo amplifier. When using a varistor, connect it between each phase of the input power supply of the equipment. For varistors, the TND20V-431K, TND20V-471K and TND20V-102K, manufactured by Nippon Chemi-Con, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Power supply voltage	Varistor	Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1 mA
		Permissible circuit voltage		Surge current immunity	Energy immunity	Rated pulse power	[A]	[V]		
		AC [Vrms]	DC [V]	8/20 μs [A]	2 ms [J]	[W]			[pF]	[V]
200 V/ 100 V class	TND20V-431K	275	350	10000/1 time	195	1.0	100	710	1300	430 (387 to 473)
	TND20V-471K	300	385	7000/2 times	215			775	1200	470 (423 to 517)
400 V class	TND20V-102K	625	825	7500/1 time 6500/2 times	400	1.0	100	1650	560	1000 (900 to 1100)

[Unit: mm]



Model	D Max.	H Max.	T Max.	E ±1.0	(Note) L min.	φd ±0.05	W ±1.0
TND20V-431K	21.5	24.5	6.4	3.3	20	0.8	10.0
TND20V-471K			6.6	3.5			
TND20V-102K	22.5	25.5	9.5	6.4	20	0.8	10.0

Note. For items with special lead length (L), contact the manufacturer.

11.15 Earth-leakage current breaker

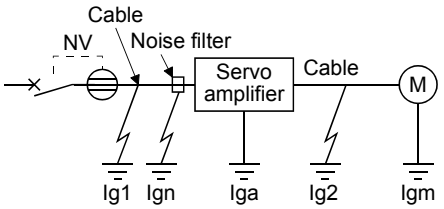
(1) Selection method

High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits. Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.

Select an earth-leakage current breaker according to the following formula, and ground the servo amplifier, servo motor, etc. securely.

To minimize leakage currents, make the input and output cables as short as possible, and make the grounding cable longer than 30 cm.

Rated sensitivity current ≥ 10 • {Ig1 + Ign + Iga + K • (Ig2 + Igm)} [mA]····· (11.1)



Earth-leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-HW	1
General models	BV-C1 NFB NV-L	3

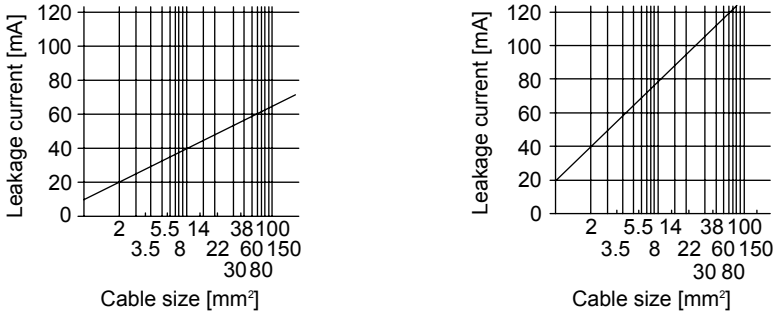
Ig1: Leakage current on the electric channel from the earth-leakage current breaker to the input terminals of the servo amplifier (Found from Fig. 11.13.)

Ig2: Leakage current on the electric channel from the output terminals of the servo amplifier to the servo motor (found from Fig. 11.13.)

Ign: Leakage current when a filter is connected to the input side (4.4 mA per one FR-BIF or FR-BIF-H)

Iga: Leakage current of the servo amplifier (Found from table 11.6.)

Igm: Leakage current of the servo motor (Found from table 11.5.)



200 V/100 V class (Note) 400 V class

Note. "Ig1" of 100 V class servo amplifiers will be 1/2 of 200 V class servo amplifiers.

Fig. 11.13 Example of leakage current per km (Ig1, Ig2) for CV cable run in metal conduit

Table 11.5 Servo motor leakage current example (Igm)

Servo motor power [kW]	Leakage current [mA]
0.05 to 1	0.1
1.2 to 2	0.2
3 to 3.5	0.3
4.2 to 5	0.5
7	0.7
9 to 11	1.0
15	1.3
22	2.3

Table 11.6 Servo amplifier leakage current example (Iga)

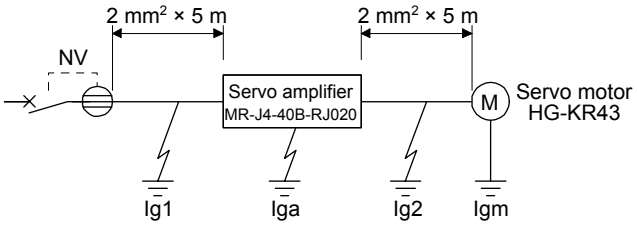
Servo amplifier capacity [kW]	Leakage current [mA]
0.1 to 0.6	0.1
0.75 to 3.5	0.15
5/7	2
11/15	5.5
22	7

Table 11.7 Earth-leakage current breaker selection example

Servo amplifier	Rated sensitivity current of earth-leakage current breaker [mA]
MR-J4-10B-RJ020 to MR-J4-350B-RJ020 MR-J4-60B4-RJ020 to MR-J4-350B4-RJ020 MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020	15
MR-J4-500B-RJ020 MR-J4-500B4-RJ020	30
MR-J4-700B-RJ020 MR-J4-700B4-RJ020	50
MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020 MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020	100

(2) Selection example

Indicated below is an example of selecting an earth-leakage current breaker under the following conditions.



Use an earth-leakage current breaker designed for suppressing harmonics/surges.
Find the terms of equation (11.1) from the diagram.

$$Ig1 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

$$Ig2 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

Ign = 0 (not used)

Iga = 0.1 [mA]

Igm = 0.1 [mA]

Insert these values in equation (11.1).

$$Ig \geq 10 \cdot \{0.1 + 0 + 0.1 + 1 \cdot (0.1 + 0.1)\}$$
$$\geq 4 \text{ [mA]}$$

According to the result of calculation, use an earth-leakage current breaker having the rated sensitivity current (Ig) of 4.0 mA or more.
An earth-leakage current breaker having Ig of 15 mA is used with the NV-SP/SW/CP/CW/HW series.

11.16 EMC filter (recommended)

It is recommended that one of the following filters be used to comply with EN EMC directive. Some EMC filters have large in leakage current. When using an EMC filter, always use one for each servo amplifier.

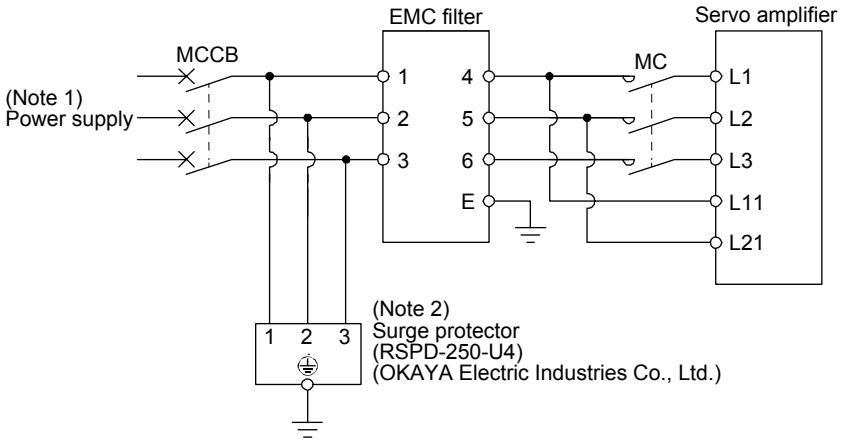
(1) Combination with the servo amplifier

Servo amplifier	Recommended filter (Soshin Electric)				Mass [kg]
	Model	Rated current [A]	Rated voltage [VAC]	Leakage current [mA]	
MR-J4-10B-RJ020 to MR-J4-100B-RJ020	(Note) HF3010A-UN	10	250	5	3.5
MR-J4-200B-RJ020 MR-J4-350B-RJ020	(Note) HF3030A-UN	30			5.5
MR-J4-500B-RJ020 MR-J4-700B-RJ020	(Note) HF3040A-UN	40		6.5	6
MR-J4-11KB-RJ020 MR-J4-15KB-RJ020 MR-J4-22KB-RJ020	(Note) HF3100A-UN	100			12
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020	TF3005C-TX	5	500	5.5	6
MR-J4-200B4-RJ020 to MR-J4-700B4-RJ020	TF3020C-TX	20			
MR-J4-11KB4-RJ020	TF3030C-TX	30			7.5
MR-J4-15KB4-RJ020	TF3040C-TX	40			12.5
MR-J4-22KB4-RJ020	TF3060C-TX	60			
MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020	(Note) HF3010A-UN	10	250	5	3.5

Note. A surge protector is separately required to use any of these EMC filters.

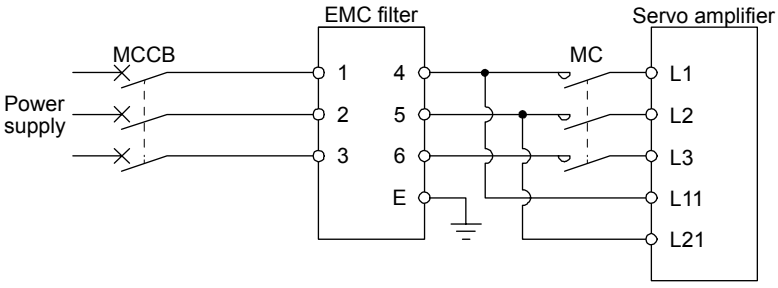
(2) Connection example

(a) 200 V/100 V class



Note 1. For power supply specifications, refer to section 1.3.1.
2. The example is when a surge protector is connected.

(b) 400 V class

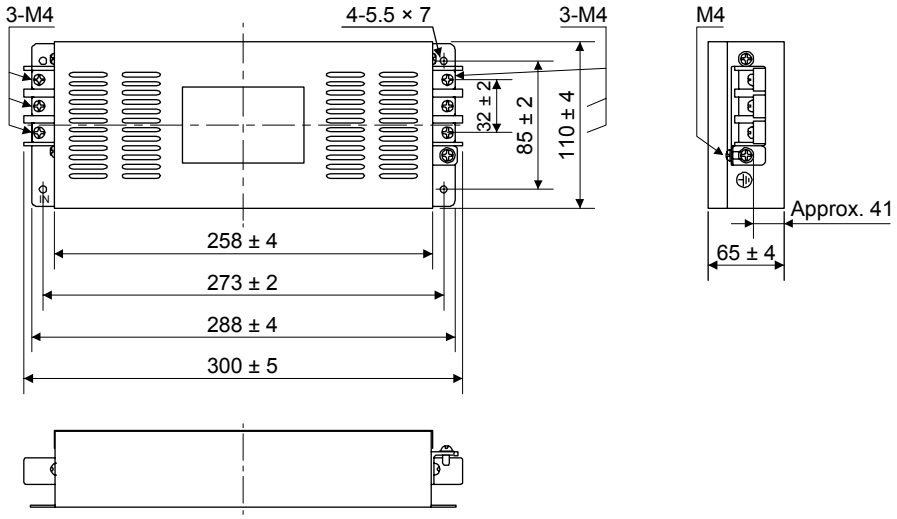


(3) Dimensions

(a) EMC filter

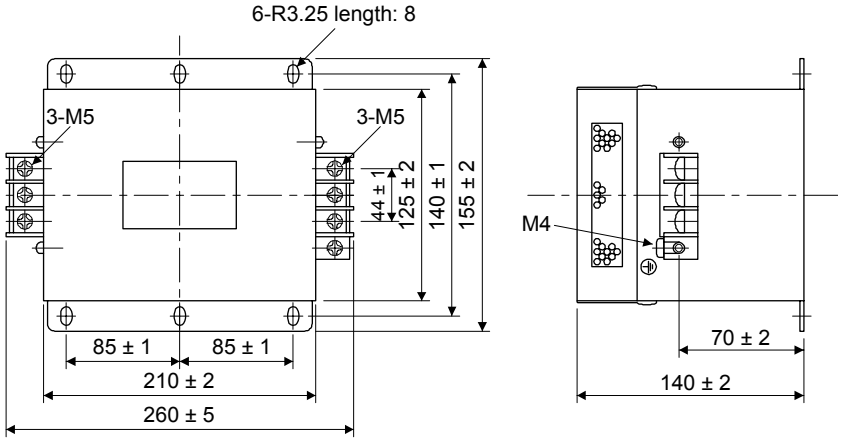
HF3010A-UN

[Unit: mm]



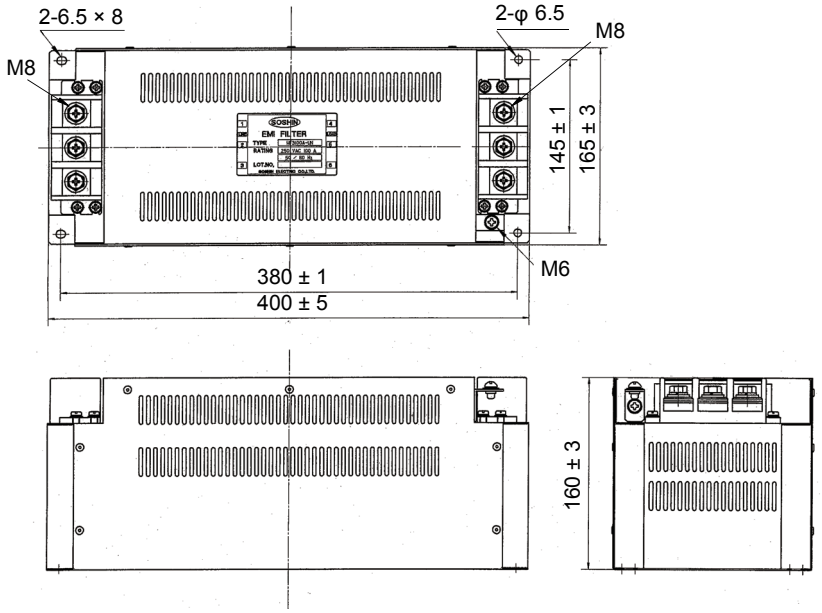
HF3030A-UN/HF-3040A-UN

[Unit: mm]



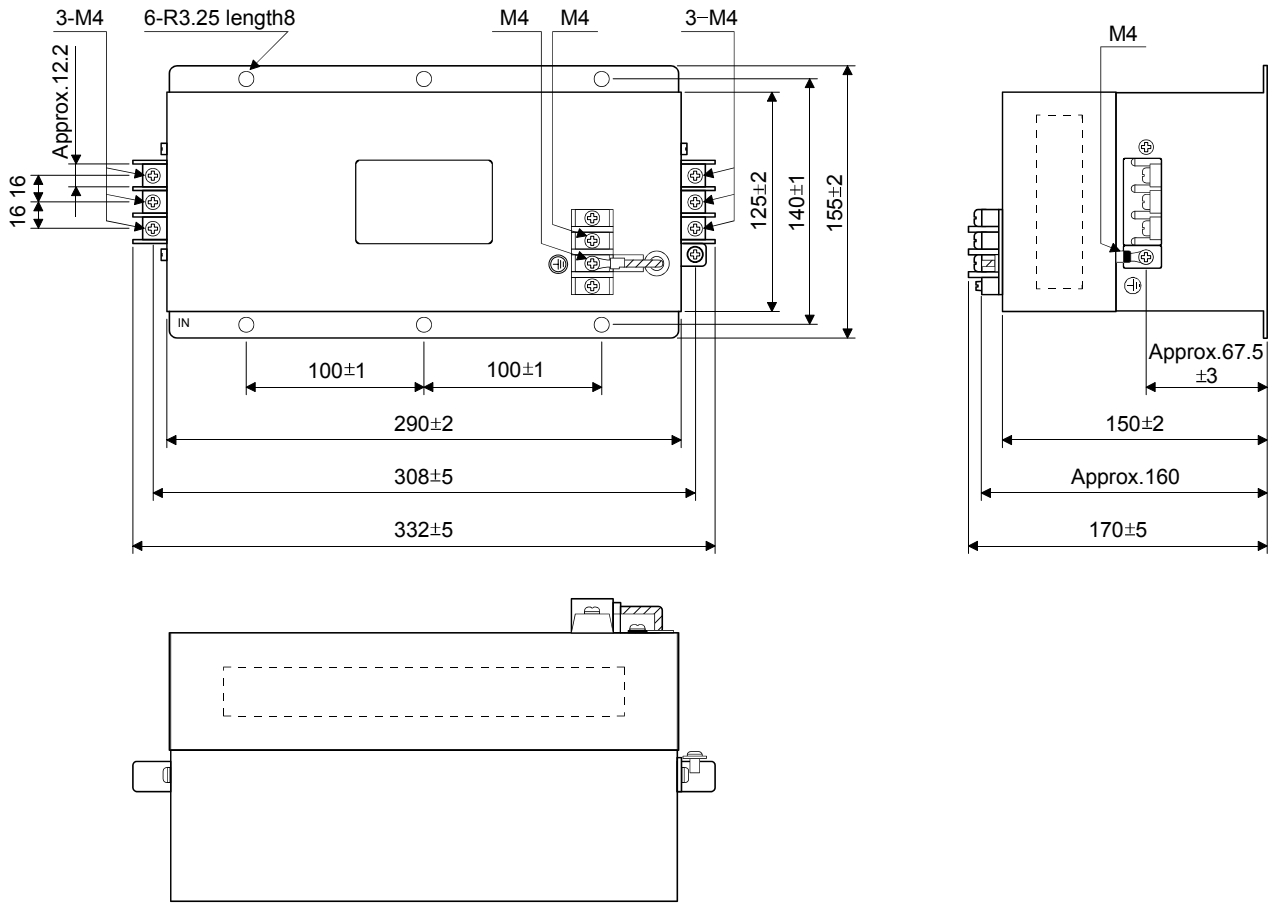
HF3100A-UN

[Unit: mm]



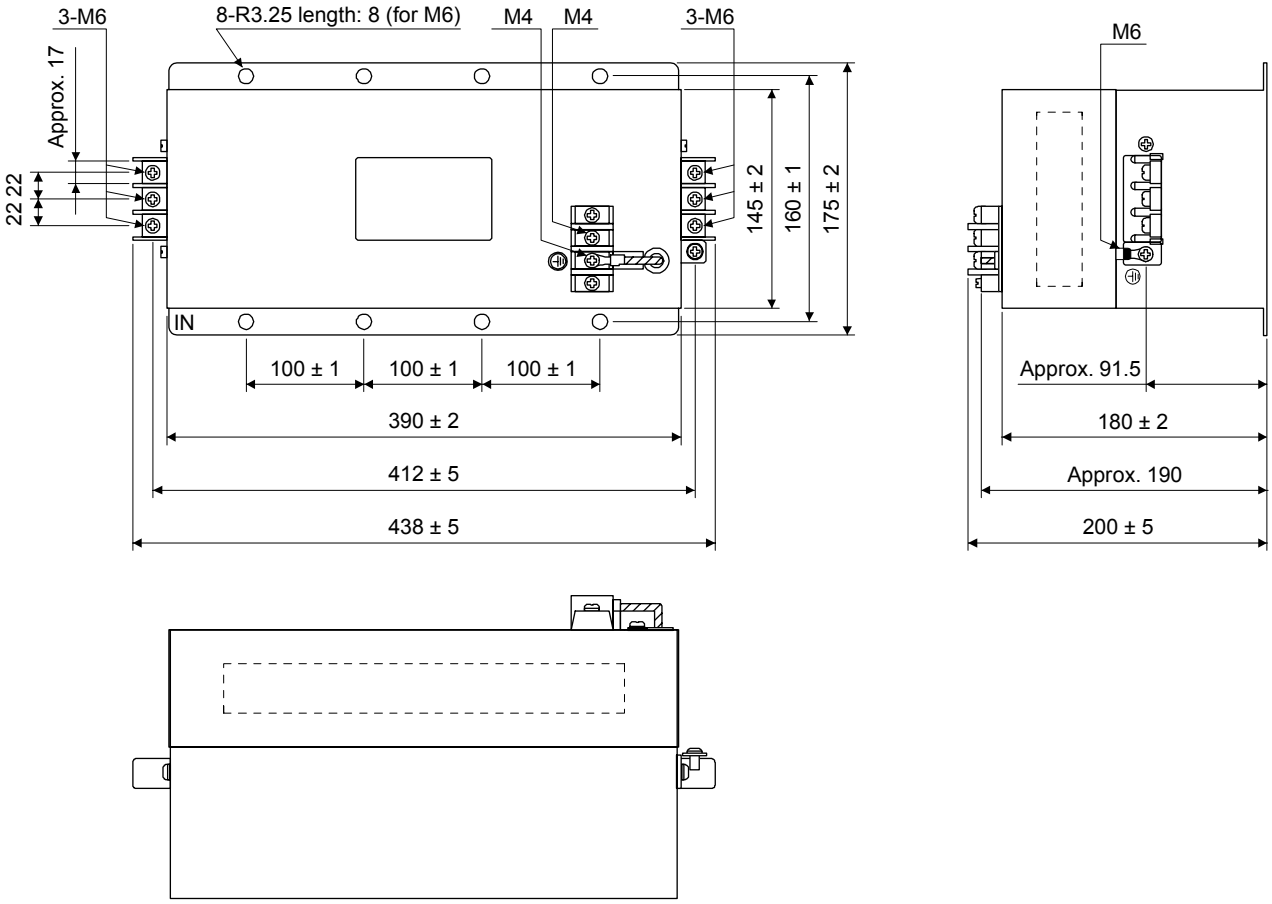
TF3005C-TX/TF3020C-TX/TF3030C-TX

[Unit: mm]



TF3040C-TX/TF3060C-TX

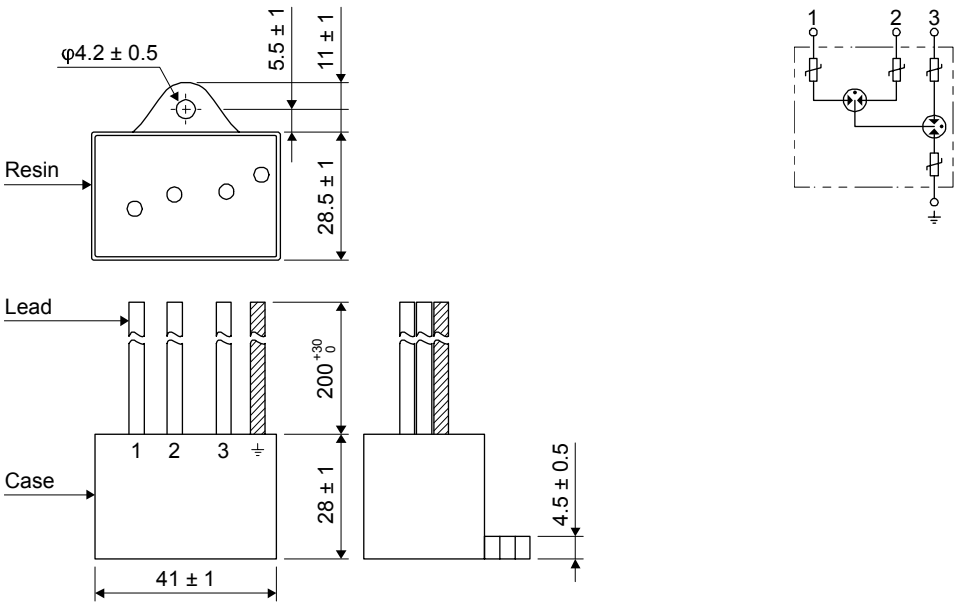
[Unit: mm]



(b) Surge protector

RSPD-250-U4

[Unit: mm]



11.17 External dynamic brake

⚠CAUTION	●Use an external dynamic brake for a servo amplifier of MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020. Failure to do so will cause an accident because the servo motor does not stop immediately but coasts at an alarm occurrence for which the servo motor does not decelerate to stop. Ensure the safety in the entire equipment.

POINT

●Configure a sequence which switches off the magnetic contactor of the external dynamic brake after (or as soon as) servo-on command has been turned off at a power failure or a malfunction.
●For the braking time taken when the dynamic brake is operated, refer to section 10.3.
●The external dynamic brake is rated for a short duration. Do not use it very frequently.
●When using the 400 V class external dynamic brake, the power supply voltage is restricted to 1-phase 380 V AC to 463 V AC (50 Hz/60 Hz).
●When an alarm, [AL. E6 Servo forced stop warning], or [AL. E6 Controller forced stop warning] occurs, or the power is turned off, the external dynamic brake will operate. Do not use dynamic brake to stop in a normal operation as it is the function to stop in emergency.
●For a machine operating at the recommended load to motor inertia ratio or less, the estimated number of usage times of the dynamic brake is 1000 times while the machine decelerates from the rated speed to a stop once in 10 minutes.
●Be sure to enable EM1 (Forced stop) after servo motor stops when using EM1 (Forced stop) frequently in other than emergency.

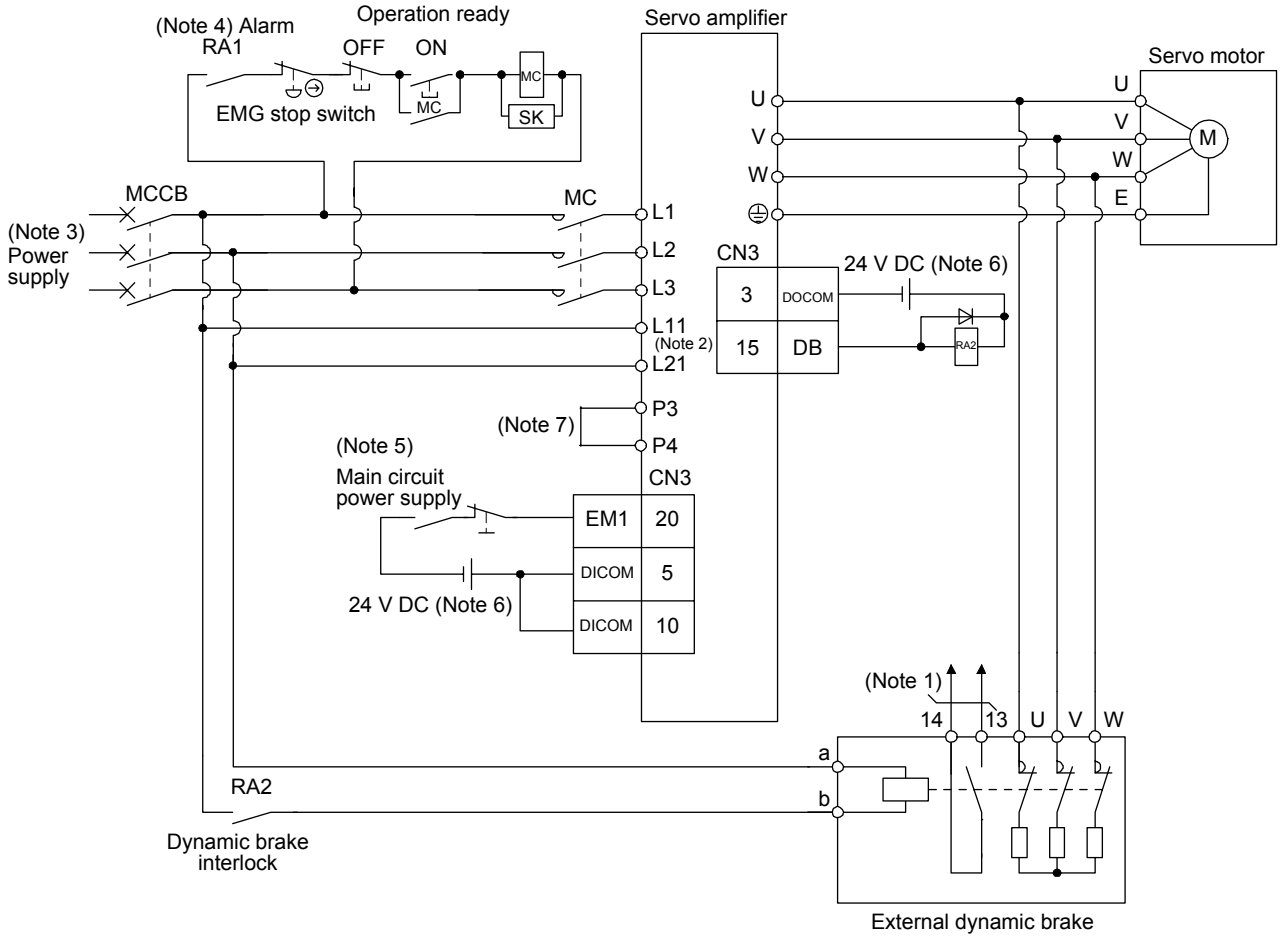
(1) Selection of external dynamic brake

The dynamic brake is designed to bring the servo motor to a sudden stop when a power failure occurs or the protective circuit is activated, and is built in the 7 kW or less servo amplifier. Since it is not built in the 11 kW or more servo amplifier, purchase it separately. Set [Pr. 2] to "_ 1 _ _".

Servo amplifier	External dynamic brake
MR-J4-11KB-RJ020	DBU-11K
MR-J4-15KB-RJ020	DBU-15K
MR-J4-22KB-RJ020	DBU-22K-R1
MR-J4-11KB4-RJ020	DBU-11K-4
MR-J4-15KB4-RJ020	DBU-22K-4
MR-J4-22KB4-RJ020	

(2) Connection example

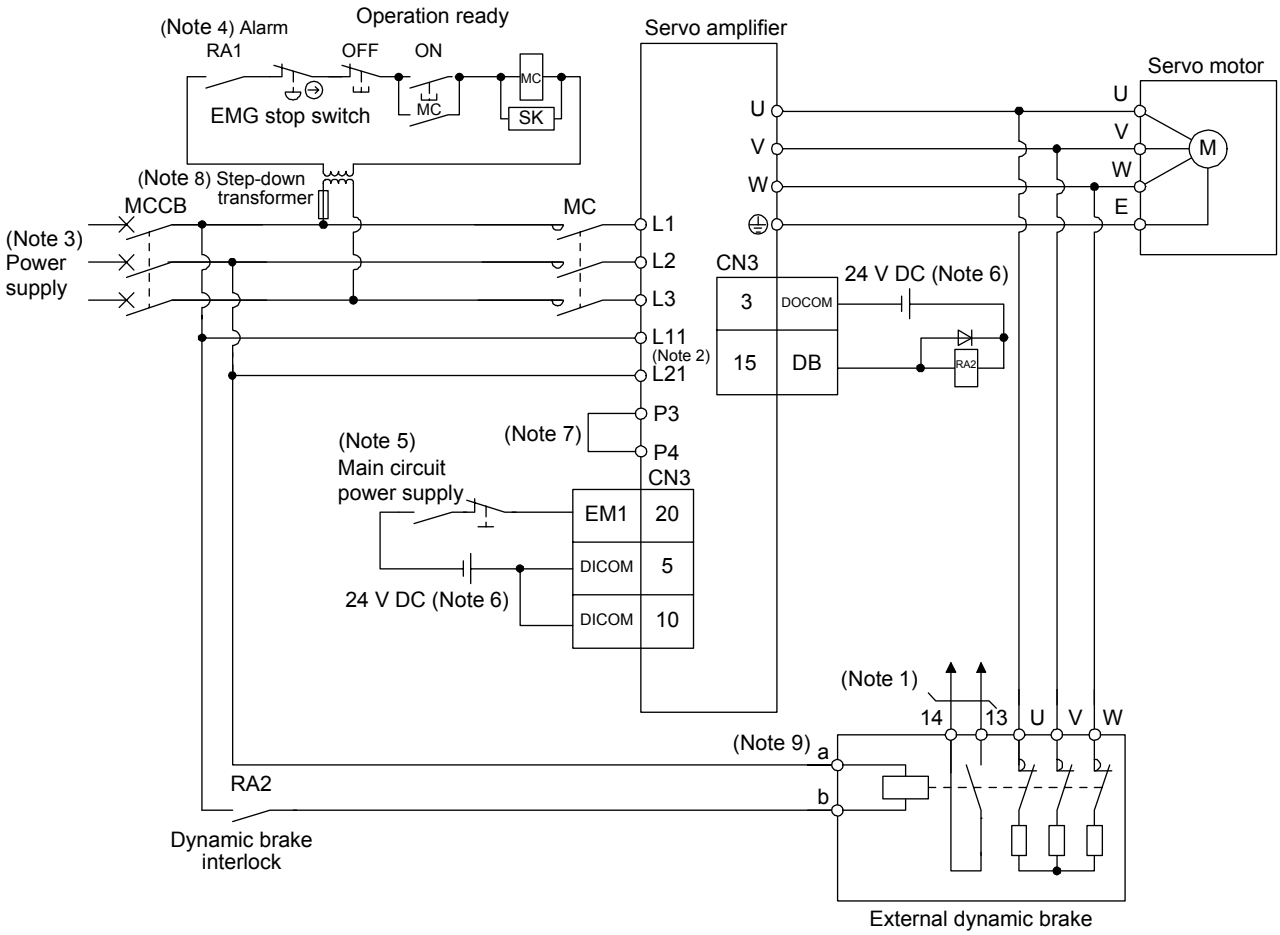
(a) 200 V class



Note 1. Terminals 13 and 14 are normally open contact outputs. If the external dynamic brake is seized, terminals 13 and 14 will open. Therefore, configure an external sequence to prevent servo-on.

2. To enable DB (Dynamic brake interlock), set [Pr. 2] to "_ 1 _ _".
3. For the power supply specifications, refer to section 1.3.
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. Turn off EM1 when the main power circuit power supply is off.
6. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
7. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.

(b) 400 V class

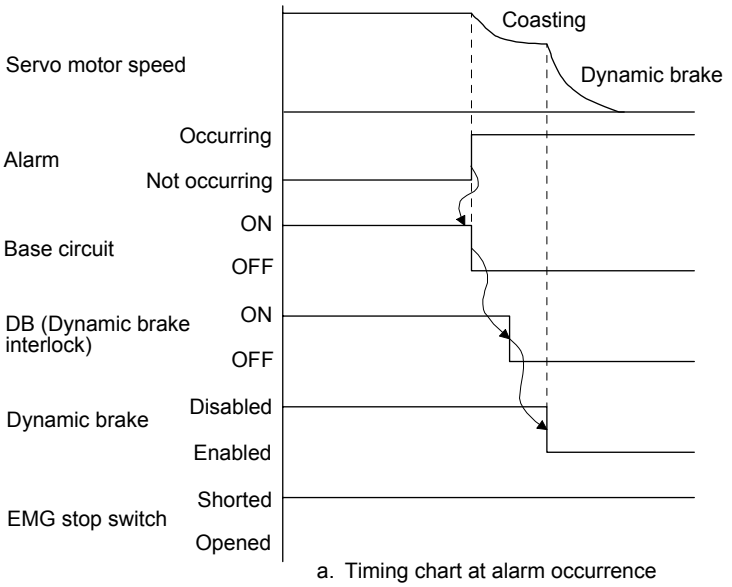


Note 1. Terminals 13 and 14 are normally open contact outputs. If the external dynamic brake is seized, terminals 13 and 14 will open. Therefore, configure an external sequence to prevent servo-on.

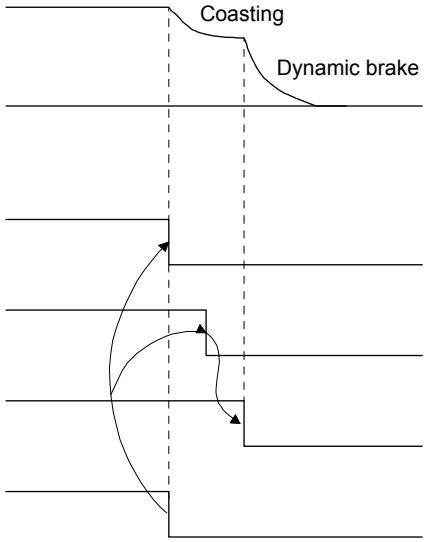
2. To enable DB (Dynamic brake interlock), set [Pr. 2] to "_ 1 _ _".
3. For the power supply specifications, refer to section 1.3.
4. Configure the power supply circuit which turns off the magnetic contactor after detection of alarm occurrence on the controller side.
5. Turn off EM1 when the main power circuit power supply is off.
6. The illustration of the 24 V DC power supply is divided between input signal and output signal for convenience. However, they can be configured by one.
7. Between P3 and P4 is connected by default. When using the power factor improving DC reactor, remove the short bar between P3 and P4. Refer to section 11.11 for details. Additionally, a power factor improving DC reactor and power factor improving AC reactor cannot be used simultaneously.
8. Stepdown transformer is required when the coil voltage of the magnetic contactor is 200 V class.
9. The power supply voltage of the inside magnet contactor for 400 V class external dynamic brake DBU-11K-4 and DBU-22K-4 is restricted as follows. When using these external dynamic brakes, use them within the range of the power supply.

External dynamic brake	Power supply voltage
DBU-11K-4 DBU-22K-4	1-phase 380 V AC to 463 V AC, 50 Hz/60 Hz

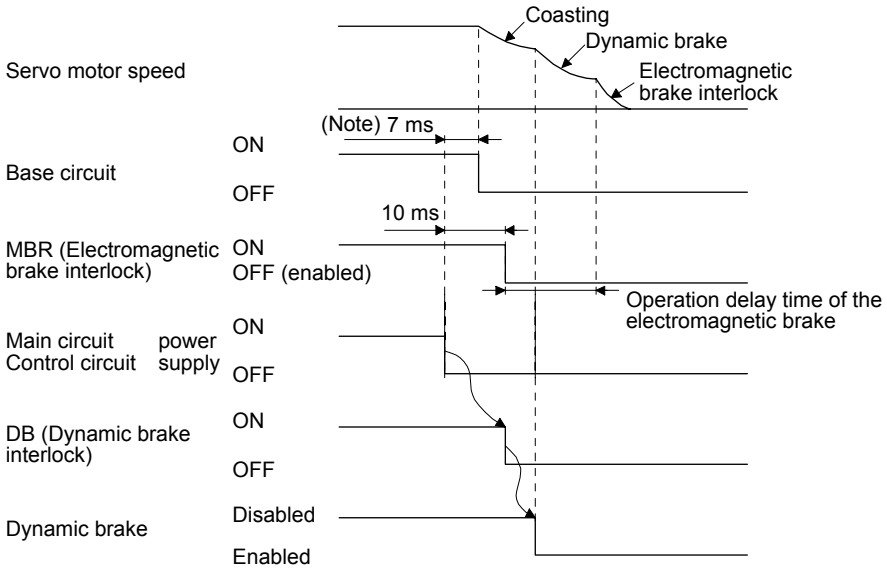
(3) Timing chart



a. Timing chart at alarm occurrence



b. Timing chart at EMG stop switch enabled



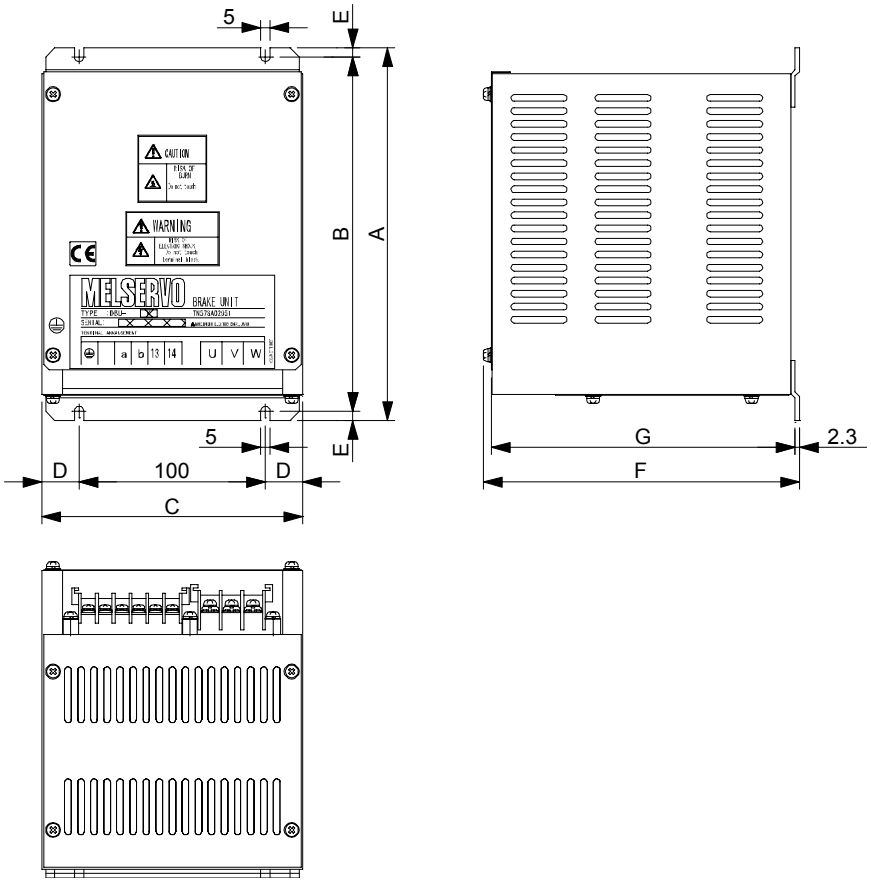
Note. When powering off, DB (Dynamic brake interlock) will be turned off, and the base circuit is turned off earlier than usual before an output shortage occurs.

c. Timing chart when both of the main and control circuit power are off

(4) Dimensions

(a) DBU-11K/DBU-15K/DBU-22K-R1

[Unit: mm]



Terminal block

⏚		a	b	13	14

Screw: M3.5
Tightening torque: 0.8 [N•m]

U	V	W

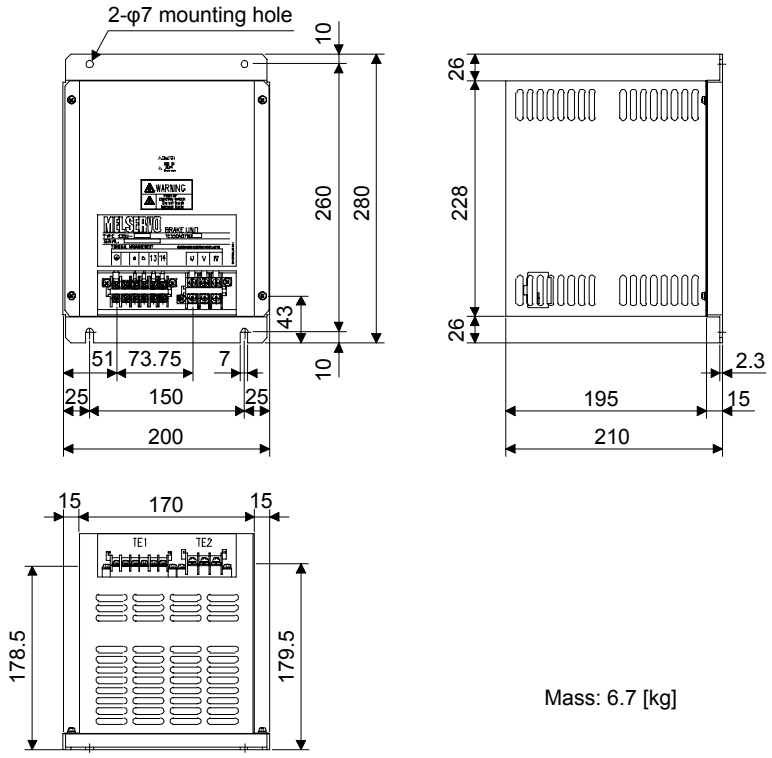
Screw: M4
Tightening torque: 1.2 [N•m]

External dynamic brake	A	B	C	D	E	F	G	Mass [kg]	(Note) Connection wire [mm^2]	
									U/V/W	Except U/V/W
DBU-11K	200	190	140	20	5	170	163.5	2	5.5 (AWG 10)	2 (AWG 14)
DBU-15K/DBU-22K-R1	250	238	150	25	6	235	228	6	5.5 (AWG 10)	2 (AWG 14)

Note. Selection conditions of wire size is as follows.
Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Construction condition: Single wire set in the air

(b) DBU-11K-4/DBU-22K-4

[Unit: mm]



Mass: 6.7 [kg]

Terminal block

TE1

⏚		a	b	13	14

Screw: M3.5
Tightening torque: 0.8 [N•m]

TE2

U	V	W

Screw: M4
Tightening torque: 1.2 [N•m]

External dynamic brake	(Note) Connection wire [mm^2]	
	U/V/W	Except U/V/W
DBU-11K-4	5.5 (AWG 10)	2 (AWG 14)
DBU-22K-4	5.5 (AWG 10)	2 (AWG 14)

Note. Selection conditions of wire size is as follows.
Wire type: 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Construction condition: Single wire set in the air

11.18 Heat sink outside mounting attachment (MR-J4ACN15K/MR-J3ACN)

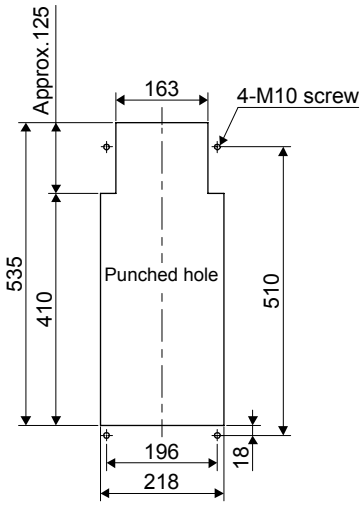
Use the heat sink outside mounting attachment to mount the heat generation area of the servo amplifier in the outside of the cabinet to dissipate servo amplifier-generated heat to the outside of the cabinet and reduce the amount of heat generated in the cabinet. In addition, designing a compact cabinet is allowed.
In the cabinet, machine a hole having the panel cut dimensions, fit the heat sink outside mounting attachment to the servo amplifier with the fitting screws (4 screws supplied), and install the servo amplifier to the cabinet.
Please prepare screws for mounting. They do not come with.
The environment outside the cabinet when using the heat sink outside mounting attachment should be within the range of the servo amplifier operating environment.
The heat sink outside mounting attachment can be used for MR-J4-11KB-RJ020 to MR-J4-22KB-RJ020/MR-J4-11KB4-RJ020 to MR-J4-22KB4-RJ020.
The following shows the combinations.

Servo amplifier	Heat sink outside mounting attachment
MR-J4-11KB-RJ020 MR-J4-15KB-RJ020	MR-J4ACN15K
MR-J4-22KB-RJ020	MR-J3ACN
MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020	MR-J4ACN15K
MR-J4-22KB4-RJ020	MR-J3ACN

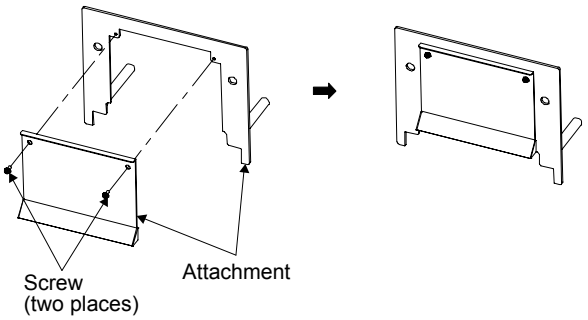
(1) MR-J4ACN15K

(a) Panel cut dimensions

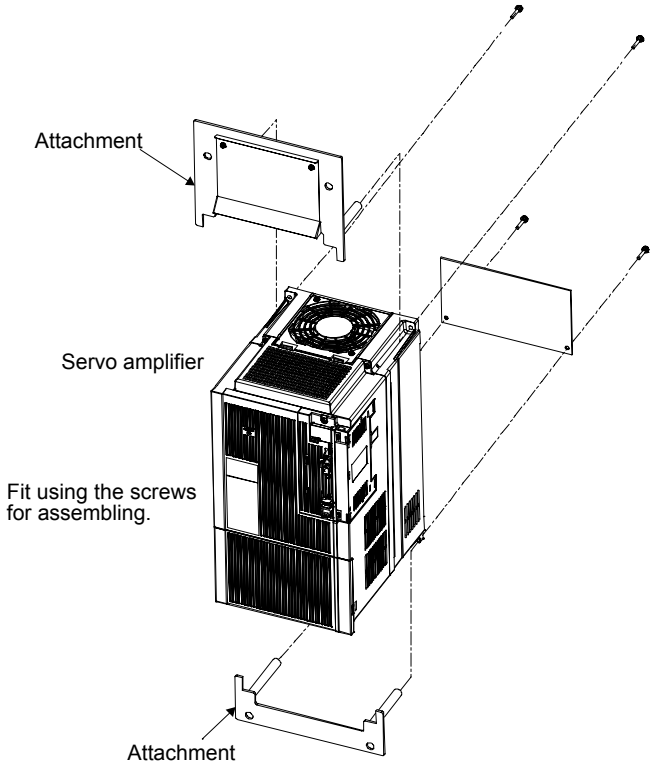
[Unit: mm]



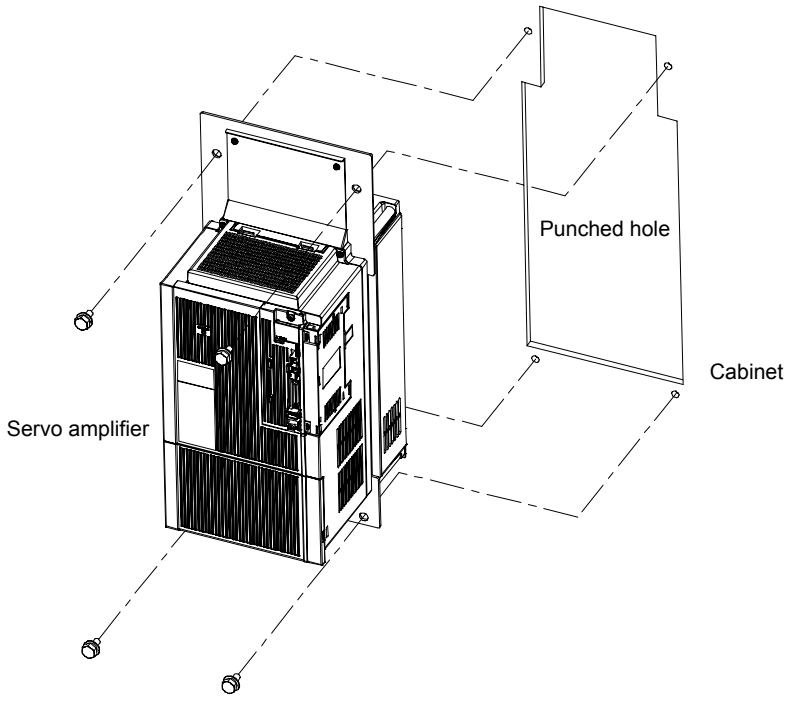
(b) How to assemble the attachment for heat sink outside mounting attachment



(c) Mounting method



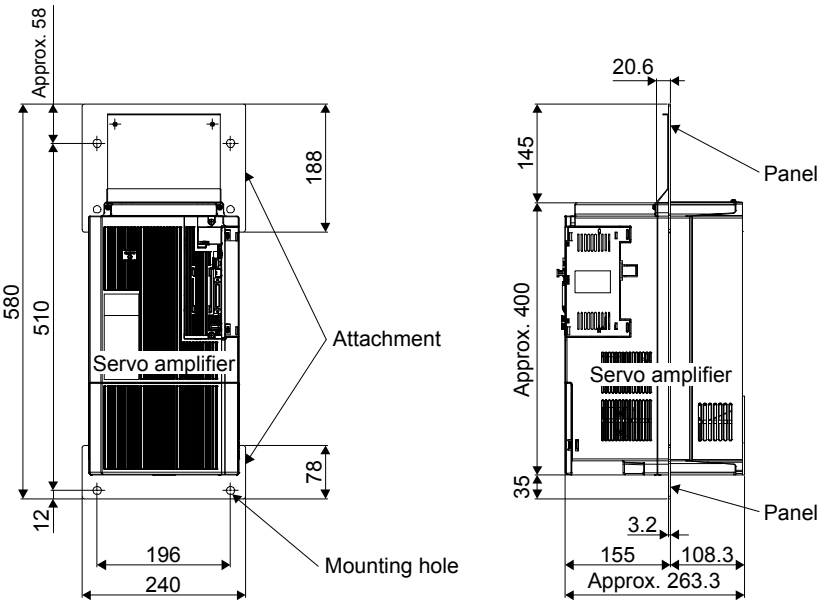
a. Assembling the heat sink outside mounting attachment



b. Mounting it to inside cabinet

(d) Mounting dimensional diagram

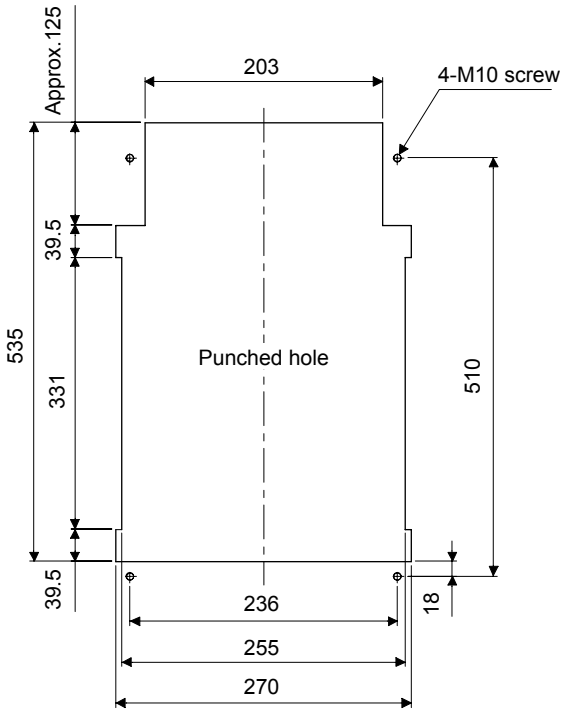
[Unit: mm]



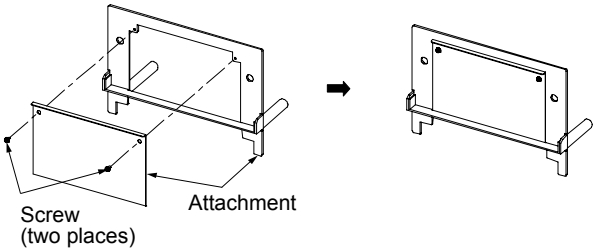
(2) MR-J3ACN

(a) Panel cut dimensions

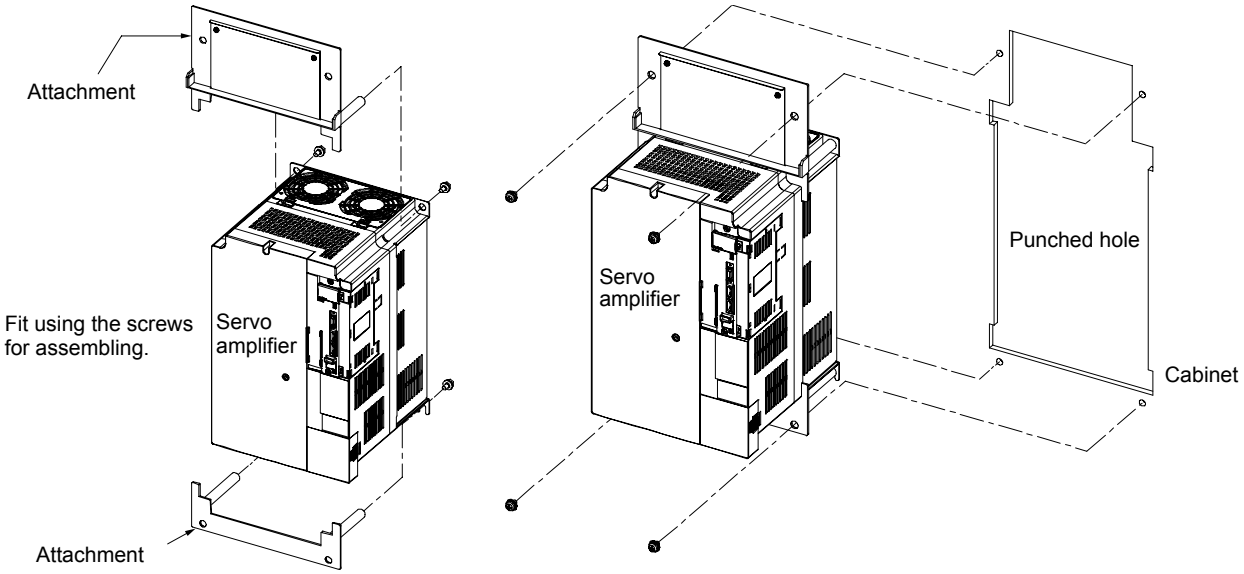
[Unit: mm]



(b) How to assemble the attachment for heat sink outside mounting attachment



(c) Mounting method

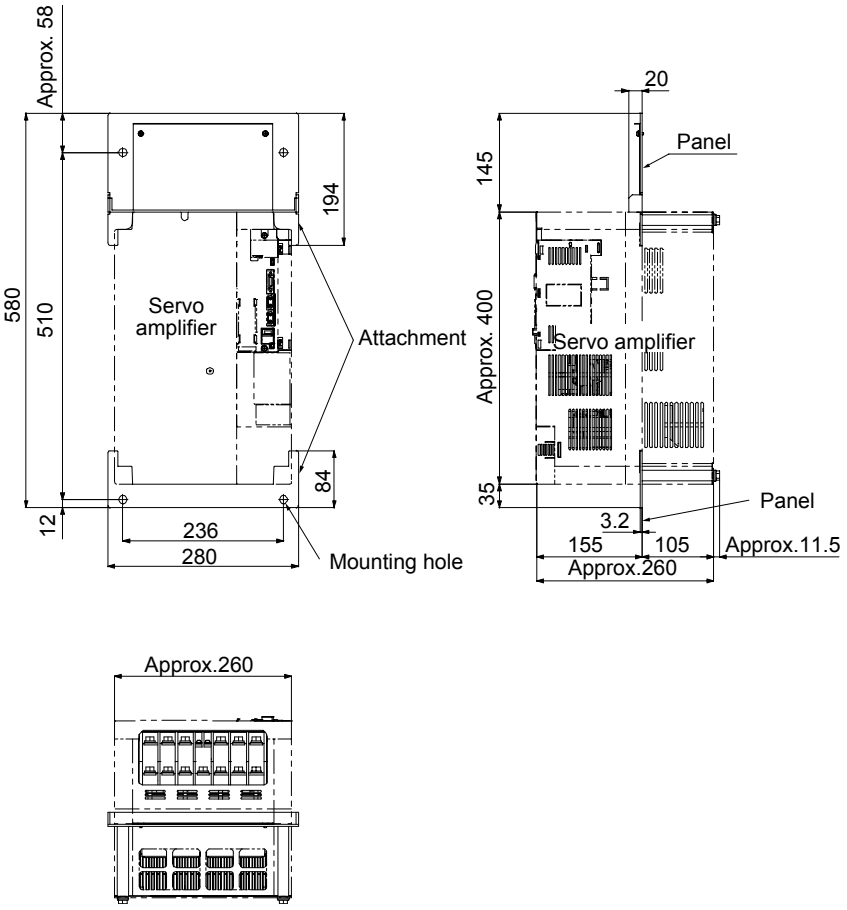


a. Assembling the heat sink outside mounting attachment

b. Mounting it to inside cabinet

(d) Mounting dimensional diagram

[Unit: mm]



MEMO

12. ABSOLUTE POSITION DETECTION SYSTEM

⚠CAUTION	●If [AL. 25 Absolute position erased] or [AL. E3 Absolute position counter warning] has occurred, always perform home position setting again. Otherwise, it may cause an unexpected operation. ●Refer to appendix 3 and 4 for battery transportation and the new EU Battery Directive. ●If [AL. 25], [AL. 92], or [AL. 9F] occurs due to such as short circuit of the battery, the MR-BAT6V1 battery can become hot. Use the MR-BAT6V1 battery with case to prevent getting burnt.

POINT

●For configuring the system absolute position detection system, there are two batteries of MR-BAT6V1SET battery and MR-BAT6V1BJ battery for junction battery cable. Compared with the MR-BAT6V1SET battery, The MR-BAT6V1BJ battery for junction battery cable has the following advantages.
- You can disconnect the encoder cable from the servo amplifier.
- You can change the battery with the control circuit power supply off.

●When absolute position data is erased from the encoder, always execute home position setting before operation. The absolute position data of the encoder will be erased in the followings. Additionally, when the battery is used out of specification, the absolute position data can be erased.
When the MR-BAT6V1SET battery was used...
- The encoder cable was disconnected.
- The battery was replaced when the control circuit power supply was off.

When the MR-BAT6V1BJ battery for junction battery cable is used...
- A connector or cable was disconnected between the servo motor and battery.
- The battery was replaced with procedures other than those of (3) in section 12.2.2.

●The MR-BAT6V1BJ battery for junction battery cable is only for the HG series servo motors.

●Power is not supplied from the SSCNET cable connection connector to the encoder. When using the servo amplifier in absolute position detection system, always connect a battery to the CN4 connector.

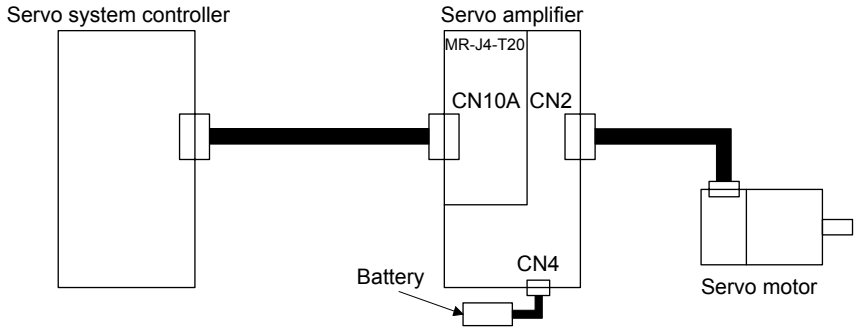
12.1 Summary

12.1.1 Features

For normal operation, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions.
The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the servo system controller power is on or off. Therefore, once home position return is made at the time of machine installation, home position return is not needed when power is switched on thereafter.
Even at a power failure or a malfunction, the system can be easily restored.

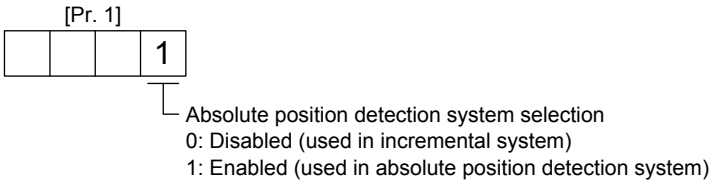
12.1.2 Structure

The following shows a configuration of the absolute position detection system. For the battery connection, refer to (2) (b) of section 12.2.1 for the MR-BAT6V1SET battery. For the battery connection, refer to (2) (b) of section 12.2.2 for the MR-BAT6V1BJ battery for junction battery cable.



12.1.3 Parameter setting

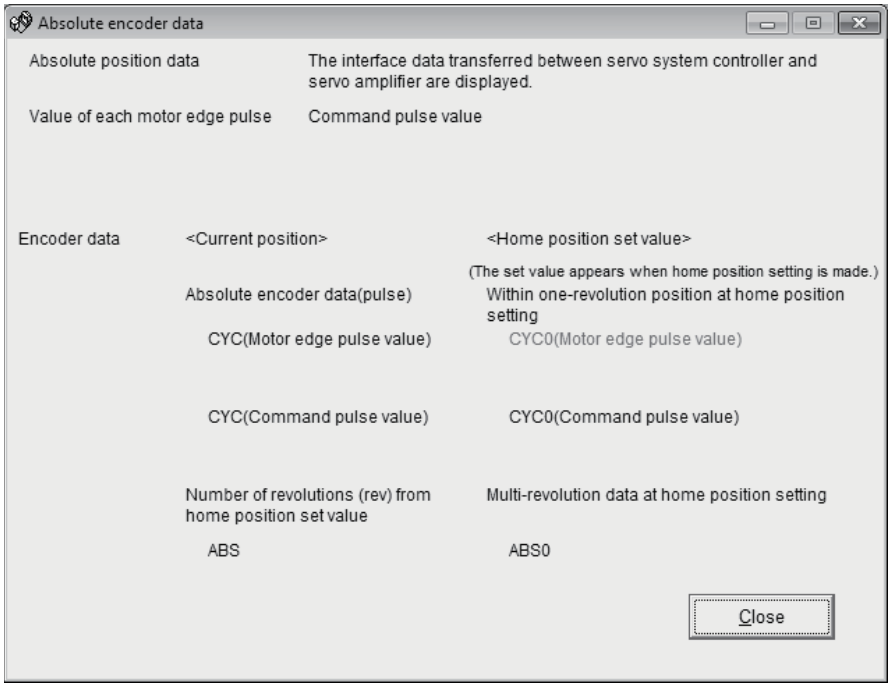
Set "_ _ _ 1" in [Pr. 1] to enable the absolute position detection system.


[Pr. 1]
1
Absolute position detection system selection
0: Disabled (used in incremental system)
1: Enabled (used in absolute position detection system)

12.1.4 Confirmation of absolute position detection data

POINT
●When using MR Configurator with the MR-J4-_B_-RJ020 servo amplifier, select "System" - "system settings" and set model selection" to "MR-J2S-B".

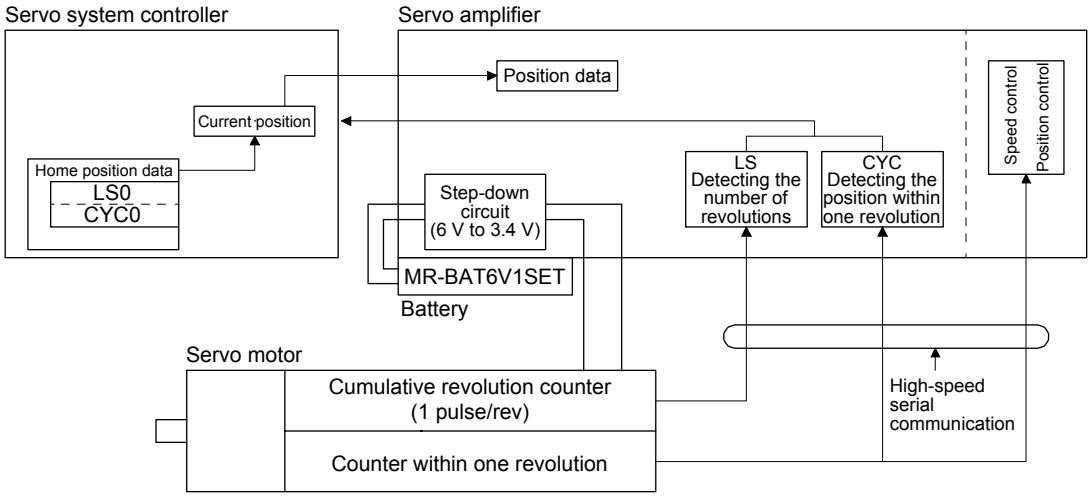
You can check the absolute position data with MR Configurator.
Choose "Diagnostics" and "Absolute encoder data" to open the absolute position data display screen.


Absolute encoder data
Absolute position data
The interface data transferred between servo system controller and servo amplifier are displayed.
Value of each motor edge pulse
Command pulse value
Encoder data
<Current position>
<Home position set value>
(The set value appears when home position setting is made.)
Absolute encoder data(pulse)
Within one-revolution position at home position setting
CYC(Motor edge pulse value)
CYC0(Motor edge pulse value)
CYC(Command pulse value)
CYC0(Command pulse value)
Number of revolutions (rev) from home position set value
Multi-revolution data at home position setting
ABS
ABS0
Close

12.2 Battery

12.2.1 Using MR-BAT6V1SET battery

(1) Configuration diagram



(2) Specifications

(a) Specification list

Item			Description
System			Electronic battery backup type
Battery	Model		MR-BAT6V1SET
	Battery pack		2CR17335A (primary lithium battery)
	Nominal voltage	[V]	6
	Nominal capacity	[mAh]	1650
	Storage temperature	[°C]	0 to 55
	Operating temperature	[°C]	0 to 55
	Amount of lithium metal	[g]	1.2
	Mercury content		Less than 1 ppm
	Dangerous goods class		Inapplicable to Class 9 (Battery pack containing 2 g or less lithium)
	Operating humidity and storage humidity		90 %RH or less (non-condensing)
	Mass	[g]	34
Maximum revolution range			Home position ± 32767 rev.
(Note 1) Maximum speed at power failure		[r/min]	6000 (only when acceleration time until 6000 r/min is 0.2 s or more)
(Note 2) Battery backup time			Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C) Approximately 29,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 4)
(Note 3) Battery life			5 years from date of manufacture

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like. Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like.

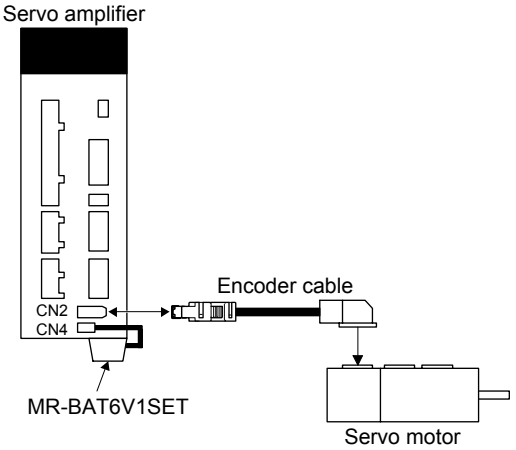
2. The data-holding time by the MR-BAT6V1SET battery. Replace the batteries within three years since the operation start regardless of the power supply of the servo amplifier on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.

3. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.

4. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

(b) Battery mounting

Connect as follows.



(3) Battery replacement procedure

⚠WARNING	●Before replacing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION	●The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions. ・Ground human body and work bench. ・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

POINT

●Replacing battery with the control circuit power off will erase the absolute position data.

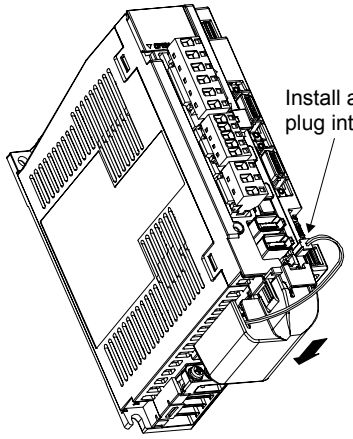
●Before replacing batteries, check that the new battery is within battery life.

Replace the battery while only control circuit power is on. Replacing battery with the control circuit power on will not erase the absolute position data.

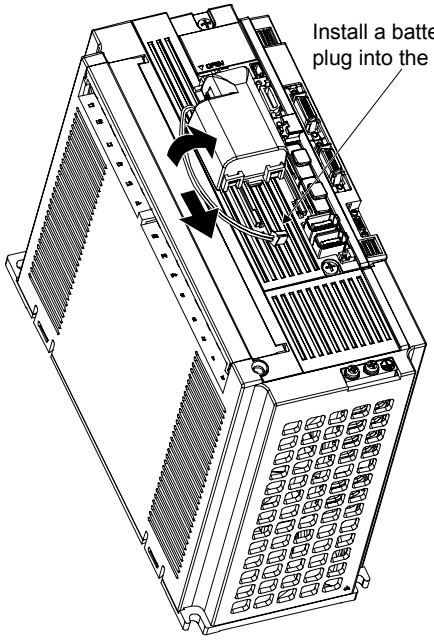
(a) Battery installation and removal procedure

1) Installation procedure

POINT
●For the servo amplifier with a battery holder on the bottom, it is not possible to wire for the earth with the battery installed. Insert the battery after executing the earth wiring of the servo amplifier.



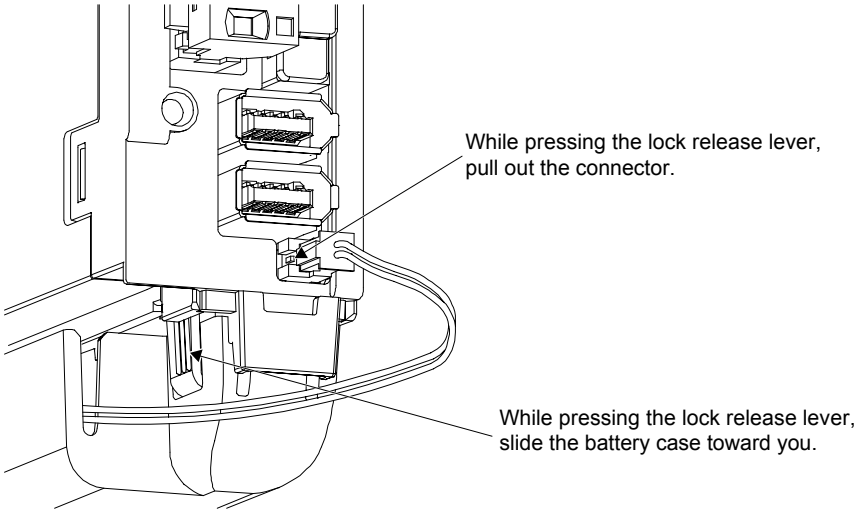
MR-J4-350B-RJ020 or less
/MR-J4-200B4-RJ020 or less
/MR-J4-40B1-RJ020 or less



MR-J4-500B-RJ020 or more
/MR-J4-350B4-RJ020 or more

2) Removal procedure

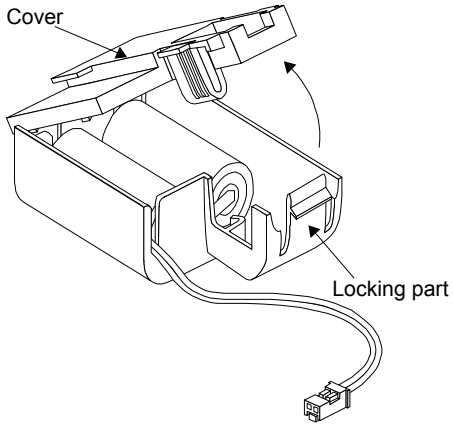
⚠CAUTION	●Pulling out the connector of the battery without the lock release lever pressed may damage the CN4 connector of the servo amplifier or the connector of the battery.


While pressing the lock release lever, pull out the connector.
While pressing the lock release lever, slide the battery case toward you.

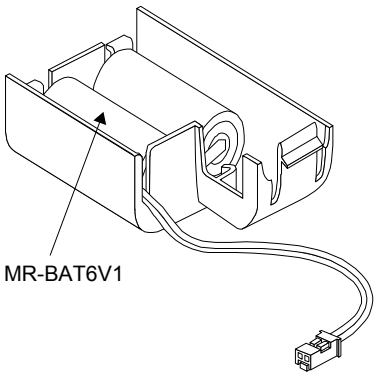
(b) Replacement procedure of the battery in the MR-BAT6V1SET

When the MR-BAT6V1SET battery reaches the end of its life, replace the MR-BAT6V1 battery in the MR-BAT6V1SET.

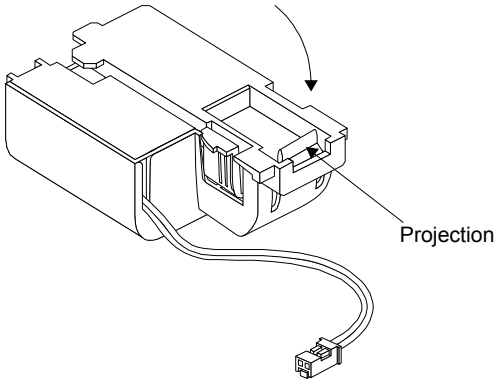
While pressing the locking part, open the cover.



Replace the battery with a new MR-BAT6V1 battery.

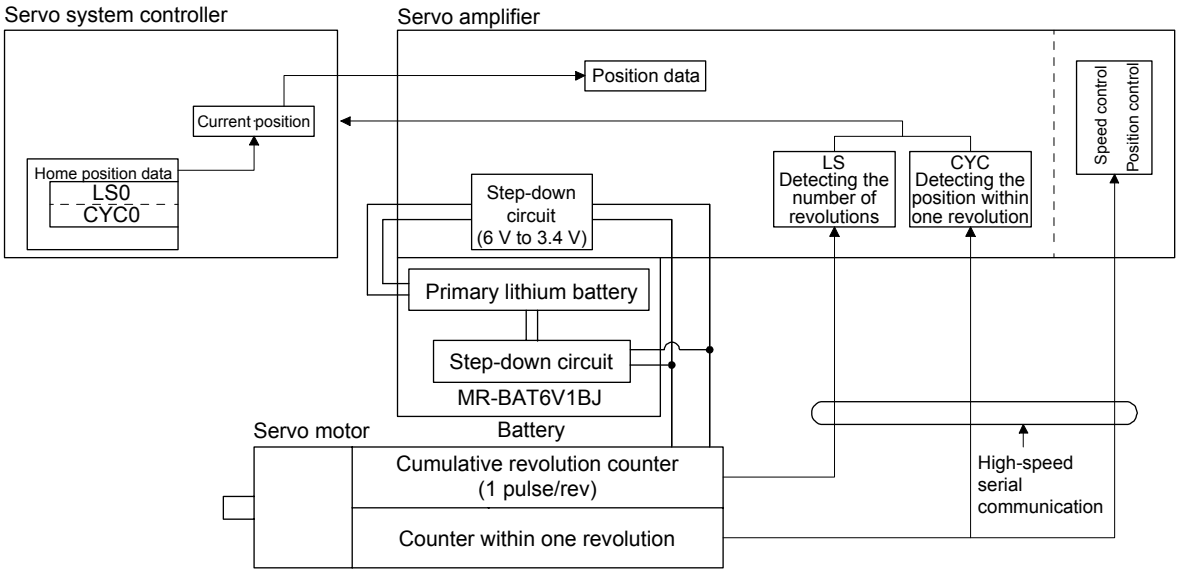


Press the cover until it is fixed with the projection of the locking part to close the cover.



12.2.2 Using MR-BAT6V1BJ battery for junction battery cable

(1) Configuration diagram



(2) Specifications

(a) Specification list

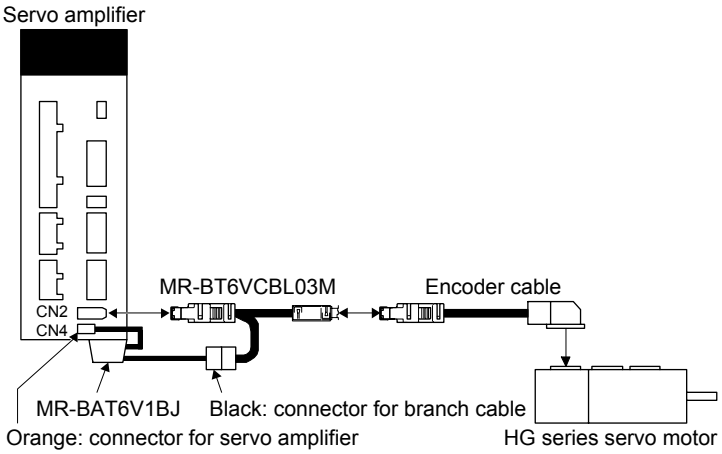
Item			Description
System			Electronic battery backup type
Battery	Model		MR-BAT6V1BJ
	Battery pack		2CR17335A (primary lithium battery)
	Nominal voltage	[V]	6
	Nominal capacity	[mAh]	1650
	Storage temperature	[°C]	0 to 55
	Operating temperature	[°C]	0 to 55
	Amount of lithium metal	[g]	1.2
	Mercury content		Less than 1 ppm
	Dangerous goods class		Inapplicable to Class 9 (Battery pack containing 2 g or less lithium)
	Operating humidity and storage humidity		90 %RH or less (non-condensing)
	Mass	[g]	66
Maximum revolution range			Home position ± 32767 rev.
(Note 1) Maximum speed at power failure		[r/min]	6000 (only when acceleration time until 6000 r/min is 0.2 s or more)
(Note 2) Battery backup time			Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C) Approximately 29,000 hours (power-on time ratio: 25%, ambient temperature: 20 °C) (Note 4)
(Note 3) Battery life			5 years from date of manufacture

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like. Also, if power is switched on at the servo motor speed of 3000 r/min or higher, position mismatch may occur due to external force or the like.
2. The data-holding time by the MR-BAT6V1BJ battery for junction battery cable. Replace the batteries within three years since the operation start regardless of the power supply of the servo amplifier on/off. If the battery is used out of specification, [AL. 25 Absolute position erased] may occur.
3. Quality of the batteries degrades by the storage condition. The battery life is 5 years from the production date regardless of the connection status.
4. The power-on time ratio 25% is equivalent to 8 hours power on for a weekday and off for a weekend.

(b) Battery mounting

POINT
●Even if the connector for branch cable connection (black) is not connected to the MR-BT6VCBL03M junction battery cable, an alarm will not occur. Check that they are connected securely. ●When you transport a servo amplifier and machine apart, disconnect only CN2 and CN4 of the servo amplifier. When other connectors or cables are disconnected between the servo motor and battery, the absolute position data will be deleted.

Connect the product using the MR-BT6VCBL03M junction battery cable as follows.



(3) Battery replacement procedure

⚠WARNING	●Before replacing a battery, turn off the main circuit power and wait for 15 minutes or longer until the charge lamp turns off. Then, check the voltage between P+ and N- with a voltage tester or others. Otherwise, an electric shock may occur. In addition, when confirming whether the charge lamp is off or not, always confirm it from the front of the servo amplifier.

⚠CAUTION	●The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions. ・Ground human body and work bench. ・Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand. ● The battery built in MR-BAT6V1BJ cannot be replaced. Therefore, please do not disassemble the MR-BAT6V1BJ battery for junction battery cable. Otherwise, it may cause a malfunction.

POINT
●To replace the MR-BAT6V1BJ battery for junction battery cable, follow the procedures given in this section to avoid erasing absolute position data. ●Before replacing batteries, check that the new battery is within battery life.

The MR-BAT6V1BJ battery for junction battery cable can be replaced with the control circuit power supply off.

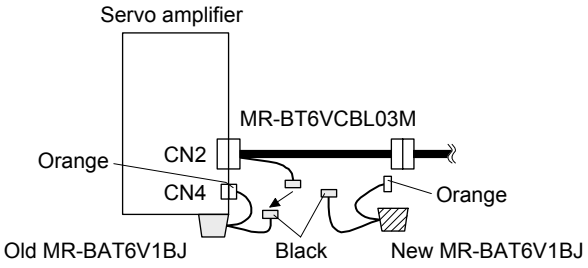
(a) Battery installation and removal procedure
The battery installation and removal procedure to the servo amplifier are the same as for the MR-BAT6V1SET battery. Refer to (3) (a) of section 12.2.1.

(b) Preparation for replacing MR-BAT6V1BJ battery for junction battery cable
Prepare a new MR-BAT6V1BJ battery for junction battery cable as follows.

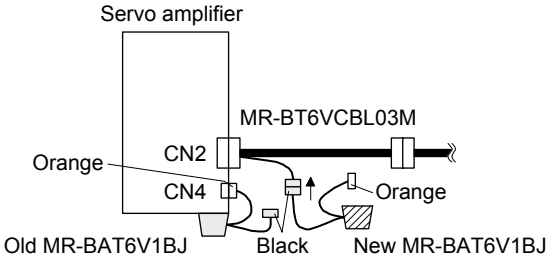
Model	Number and use	Remarks
MR-BAT6V1BJ	1 for replacement	Battery within two years from the production date.

(c) Procedures of replacing MR-BAT6V1BJ battery for junction battery cable
Replace the product as follows regardless of on/off of the control circuit power supply. When it is replaced with other procedures, the absolute position data will be erased.

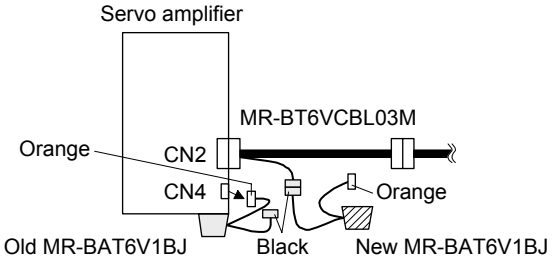
1) Disconnect the connector for branch cable connection (black) of the old MR-BAT6V1BJ battery for junction battery cable.



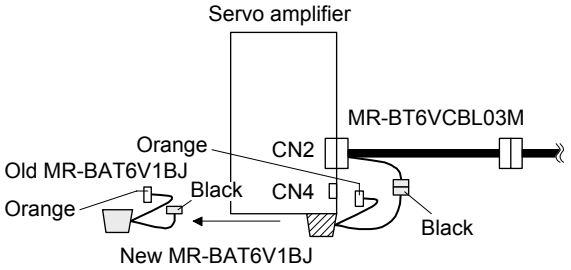
2) Connect the connector for branch cable connection (black) of the new MR-BAT6V1BJ battery for junction battery cable.



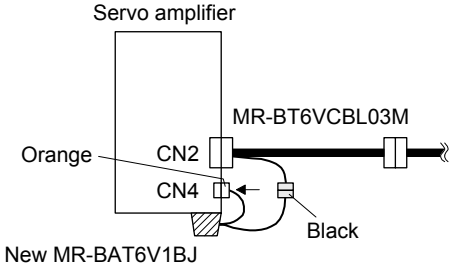
3) Disconnect the connector for servo amplifier connection (orange) of the old MR-BAT6V1BJ battery for junction battery cable.
When the control circuit power supply is on, performing 3) without [AL. 9F Battery warning] occurrence will trigger [AL. 9F].



4) Remove the old MR-BAT6V1BJ battery and mount new MR-BAT6V1BJ battery.
When the control circuit power supply is on, [AL. 9F] will occur after 3).



5) Connect the connector for servo amplifier connection (orange) of the new MR-BAT6V1BJ battery for junction battery cable.
When the control circuit power supply is on, [AL. 9F] will be canceled.



13. USING THE MR-J4-_B_-RJ020 SERVO AMPLIFIER IN THE J4 MODE

POINT

●The MR-J4-_B_-RJ020 amplifier used in the J4 mode has restrictions in terms of functions as follows as compared to the MR-J4-_B_ servo amplifier. Other functions are the same as ones for the MR-J4-_B_ servo amplifier.

Function	Availability for use	
	MR-J4-_B_	MR-J4-_B_-RJ020
CN2L connector	None	Provided (not available)
Linear servo system	Available	Not available
Direct drive servo system	Available	Not available
Fully closed loop system	Available	Not available
Scale measurement function	Available	Not available

This chapter explains the mode switching procedure when the MR-J4-_B_-RJ020 servo amplifier is used in the J4 mode, the list of parameters, and the list of alarms. For other usages, refer to the explanation on the MR-J4-_B_ servo amplifier in "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".
When you use the MR-J4-_B_-RJ020 servo amplifier in the J4 mode, it is required to switch to the J4 mode using the application "MR-J4(W)-B Change mode" came with MR Configurator2 version 1.17T or later. The application "MR-J4(W)-B Change mode" is designed for USB connection only.

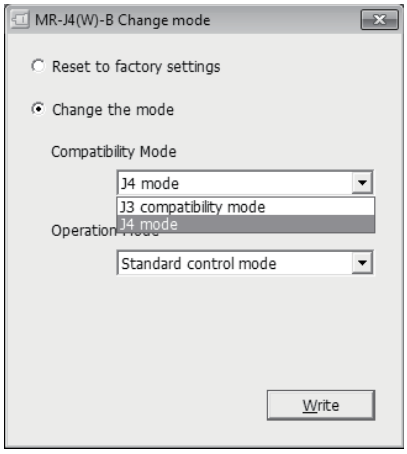
13.1 Mode switching procedure

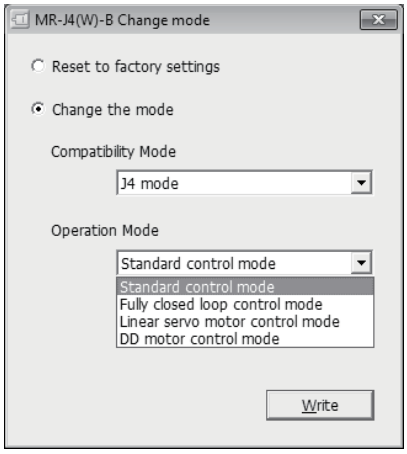
13.1.1 Switching from the J2S compatibility mode to the J4 mode

(1) Turn on the servo amplifier with MR-J4-T20 disconnected.

(2) Start the application "MR-J4(W)-B Change mode" and check that "J2S compatibility mode" is not displayed in the "compatibility mode". If it is displayed, repeat the procedure from (1) in this section again.

(3) After selecting "Change the mode", select "J4 mode". Never select other than "Standard control mode" for "Operation Mode".





(4) Press the "Write" button.

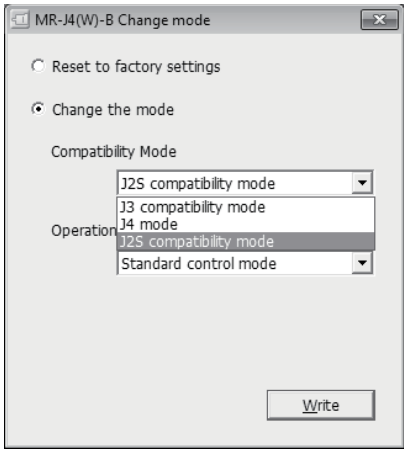
(5) Cycling the power of the servo amplifier switches the mode to the J4 mode.

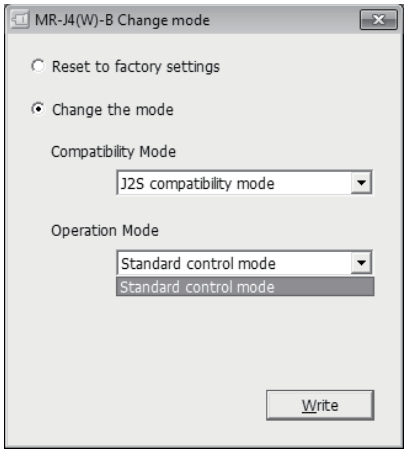
13.1.2 Switching from the J4 mode to the J2S compatibility mode

(1) Turn on the servo amplifier with MR-J4-T20 connected.

(2) Start the application "MR-J4(W)-B Change mode" and check that "J2S compatibility mode" is displayed in the "compatibility mode". If it is not displayed, repeat the procedure from (1) in this section again.

(3) After selecting "switching mode", select "J2S compatibility mode". Only "Standard control mode" can be selected for "operation mode".





(4) Press the "Write" button.

(5) Cycling the power of the servo amplifier switches the mode to the J2S compatibility mode.

13.2 Parameter

⚠CAUTION

- Never make a drastic adjustment or change to the parameter values as doing so will make the operation unstable.
- If fixed values are written in the digits of a parameter, do not change these values.
- Do not change parameters for manufacturer setting.
- Do not set a value other than the described values to each parameter.
- The parameters of J4 mode are different from those of J2S compatibility mode.

POINT

- When you connect the amplifier to a servo system controller, servo parameter values of the servo system controller will be written to each parameter.
- Setting may not be made to some parameters and their ranges depending on the servo system controller model, servo amplifier software version, and MR Configurator2 software version. For details, refer to the servo system controller user's manual.

13.2.1 Parameter list

POINT

●The parameter whose symbol is preceded by * is enabled under the following conditions:
*: After setting the parameter, cycle the power or reset the controller.
**: After setting the parameter, cycle the power.

(1) Basic setting parameters ([Pr. PA_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PA01	**STY	Operation mode	1000h					
PA02	**REG	Regenerative option	0000h		○			
PA03	*ABS	Absolute position detection system	0000h		○			
PA04	*AOP1	Function selection A-1	2000h		○			
PA05		For manufacturer setting	10000					
PA06			1					
PA07			1					
PA08	ATU	Auto tuning mode	0001h		○			
PA09	RSP	Auto tuning response	16		○			
PA10	INP	In-position range	1600	[pulse]	○			
PA11		For manufacturer setting	1000.0					
PA12			1000.0					
PA13			0000h					
PA14	*POL	Rotation direction selection	0		○			
PA15	*ENR	Encoder output pulses	4000	[pulse/rev]	○			
PA16	*ENR2	Encoder output pulses 2	1		○			
PA17	**MSR	Servo motor series setting	0000h					
PA18	**MTY	Servo motor type setting	0000h					
PA19	*BLK	Parameter writing inhibit	00ABh		○			
PA20	*TDS	Tough drive setting	0000h		○			
PA21	*AOP3	Function selection A-3	0001h		○			
PA22	**PCS	Position control composition selection	0000h		○			
PA23	DRAT	Drive recorder arbitrary alarm trigger setting	0000h		○			
PA24	AOP4	Function selection A-4	0000h		○			
PA25	OTHOV	One-touch tuning - Overshoot permissible level	0	[%]	○			
PA26	*AOP5	Function selection A-5	0000h		○			
PA27		For manufacturer setting	0000h					
PA28			0000h					
PA29			0000h					
PA30			0000h					
PA31			0000h					
PA32			0000h					

(2) Gain/filter setting parameters ([Pr. PB_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PB01	FILT	Adaptive tuning mode (adaptive filter II)	0000h		○			
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control II)	0000h		○			
PB03	TFBGN	Torque feedback loop gain	18000	[rad/s]	○			
PB04	FFC	Feed forward gain	0	[%]	○			
PB05		For manufacturer setting	500					
PB06	GD2	Load to motor inertia ratio	7.00	[Multiplier]	○			
PB07	PG1	Model loop gain	15.0	[rad/s]	○			
PB08	PG2	Position loop gain	37.0	[rad/s]	○			
PB09	VG2	Speed loop gain	823	[rad/s]	○			
PB10	VIC	Speed integral compensation	33.7	[ms]	○			
PB11	VDC	Speed differential compensation	980		○			
PB12	OVA	Overshoot amount compensation	0	[%]	○			
PB13	NH1	Machine resonance suppression filter 1	4500	[Hz]	○			
PB14	NHQ1	Notch shape selection 1	0000h		○			
PB15	NH2	Machine resonance suppression filter 2	4500	[Hz]	○			
PB16	NHQ2	Notch shape selection 2	0000h		○			
PB17	NHF	Shaft resonance suppression filter	0000h		○			
PB18	LPF	Low-pass filter setting	3141	[rad/s]	○			
PB19	VRF11	Vibration suppression control 1 - Vibration frequency	100.0	[Hz]	○			
PB20	VRF12	Vibration suppression control 1 - Resonance frequency	100.0	[Hz]	○			
PB21	VRF13	Vibration suppression control 1 - Vibration frequency damping	0.00		○			
PB22	VRF14	Vibration suppression control 1 - Resonance frequency damping	0.00		○			
PB23	VFBF	Low-pass filter selection	0000h		○			
PB24	*MVS	Slight vibration suppression control	0000h		○			
PB25		For manufacturer setting	0000h					
PB26	*CDP	Gain switching function	0000h		○			
PB27	CDL	Gain switching condition	10	[kpulse/s]/ [pulse]/ [r/min]	○			
PB28	CDT	Gain switching time constant	1	[ms]	○			
PB29	GD2B	Load to motor inertia ratio after gain switching	7.00	[Multiplier]	○			
PB30	PG2B	Position loop gain after gain switching	0.0	[rad/s]	○			
PB31	VG2B	Speed loop gain after gain switching	0	[rad/s]	○			
PB32	VICB	Speed integral compensation after gain switching	0.0	[ms]	○			
PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching	0.0	[Hz]	○			
PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching	0.0	[Hz]	○			
PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching	0.00		○			
PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching	0.00		○			
PB37		For manufacturer setting	1600					
PB38			0.00					
PB39			0.00					
PB40			0.00					
PB41			0					
PB42			0					
PB43			0000h					
PB44			0.00					
PB45	CNHF	Command notch filter	0000h		○			

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PB46	NH3	Machine resonance suppression filter 3	4500	[Hz]	○			
PB47	NHQ3	Notch shape selection 3	0000h		○			
PB48	NH4	Machine resonance suppression filter 4	4500	[Hz]	○			
PB49	NHQ4	Notch shape selection 4	0000h		○			
PB50	NH5	Machine resonance suppression filter 5	4500	[Hz]	○			
PB51	NHQ5	Notch shape selection 5	0000h		○			
PB52	VRF21	Vibration suppression control 2 - Vibration frequency	100.0	[Hz]	○			
PB53	VRF22	Vibration suppression control 2 - Resonance frequency	100.0	[Hz]	○			
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping	0.00		○			
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping	0.00		○			
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching	0.0	[Hz]	○			
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching	0.0	[Hz]	○			
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching	0.00		○			
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching	0.00		○			
PB60	PG1B	Model loop gain after gain switching	0.0	[rad/s]	○			
PB61		For manufacturer setting	0.0					
PB62			0000h					
PB63			0000h					
PB64			0000h					

(3) Extension setting parameters ([Pr. PC_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PC01	ERZ	Error excessive alarm level	0	[rev]	○			
PC02	MBR	Electromagnetic brake sequence output	0	[ms]	○			
PC03	*ENRS	Encoder output pulse selection	0000h		○			
PC04	**COP1	Function selection C-1	0000h		○			
PC05	**COP2	Function selection C-2	0000h		○			
PC06	*COP3	Function selection C-3	0000h		○			
PC07	ZSP	Zero speed	50	[r/min]	○			
PC08	OSL	Overspeed alarm detection level	0	[r/min]	○			
PC09	MOD1	Analog monitor 1 output	0000h		○			
PC10	MOD2	Analog monitor 2 output	0001h		○			
PC11	MO1	Analog monitor 1 offset	0	[mV]	○			
PC12	MO2	Analog monitor 2 offset	0	[mV]	○			
PC13	MOSDL	Analog monitor - Feedback position output standard data - Low	0	[pulse]	○			
PC14	MOSDH	Analog monitor - Feedback position output standard data - High	0	[10000pulses]	○			
PC15		For manufacturer setting	0					
PC16			0000h					
PC17	**COP4	Function selection C-4	0000h		○			
PC18	*COP5	Function selection C-5	0000h		○			
PC19		For manufacturer setting	0000h					
PC20	*COP7	Function selection C-7	0000h		○			

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PC21	*BPS	Alarm history clear	0000h		○			
PC22		For manufacturer setting	0					
PC23			0000h					
PC24	RSBR	Forced stop deceleration time constant	100	[ms]	○			
PC25		For manufacturer setting	0					
PC26	**COP8	Function selection C-8	0000h					
PC27	**COP9	Function selection C-9	0000h					
PC28		For manufacturer setting	0000h					
PC29	*COPB	Function selection C-B	0000h		○			
PC30		For manufacturer setting	0					
PC31	RSUP1	Vertical axis freefall prevention compensation amount	0	[0.0001rev]	○			
PC32		For manufacturer setting	0000h					
PC33			0					
PC34			100					
PC35			0000h					
PC36			0000h					
PC37			0000h					
PC38			0000h					
PC39			0000h					
PC40			0000h					
PC41			0000h					
PC42			0000h					
PC43			0000h					
PC44			0000h					
PC45			0000h					
PC46			0000h					
PC47			0000h					
PC48			0000h					
PC49			0000h					
PC50			0000h					
PC51			0000h					
PC52			0000h					
PC53			0000h					
PC54			0000h					
PC55			0000h					
PC56			0000h					
PC57			0000h					
PC58			0000h					
PC59			0000h					
PC60			0000h					
PC61			0000h					
PC62			0000h					
PC63			0000h					
PC64			0000h					

(4) I/O setting parameters ([Pr. PD_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PD01		For manufacturer setting	0000h					
PD02	*DIA2	Input signal automatic on selection 2	0000h		○			
PD03		For manufacturer setting	0020h					
PD04			0021h					
PD05			0022h					
PD06			0000h					
PD07	*DO1	Output device selection 1	0005h		○			
PD08	*DO2	Output device selection 2	0004h		○			
PD09	*DO3	Output device selection 3	0003h		○			
PD10		For manufacturer setting	0000h					
PD11	*DIF	Input filter setting (Note 1)	0004h	[ms]	○			
PD12	*DOP1	Function selection D-1	0000h		○			
PD13		For manufacturer setting	0000h					
PD14	*DOP3	Function selection D-3	0000h		○			
PD15	*IDCS	Driver communication setting (Note 2)	0000h		○			
PD16	*MD1	Driver communication setting - Master - Transmit data selection 1 (Note 2)	0000h		○			
PD17	*MD2	Driver communication setting - Master - Transmit data selection 2 (Note 2)	0000h		○			
PD18		For manufacturer setting	0000h					
PD19			0000h					
PD20	*SLA1	Driver communication setting - Slave - Master axis No. selection 1 (Note 2)	0		○			
PD21		For manufacturer setting	0					
PD22			0					
PD23			0					
PD24			0000h					
PD25			0000h					
PD26			0000h					
PD27			0000h					
PD28			0000h					
PD29			0000h					
PD30	TLC	Master-slave operation - Torque command coefficient on slave (Note 2)	0		○			
PD31	VLC	Master-slave operation - Speed limit coefficient on slave (Note 2)	0		○			
PD32	VLL	Master-slave operation - Speed limit adjusted value on slave (Note 2)	0	[r/min]	○			
PD33		For manufacturer setting	0000h					
PD34			0000h					
PD35			0000h					
PD36			0000h					
PD37			0000h					
PD38			0000h					
PD39			0000h					
PD40			0000h					
PD41			0000h					
PD42			0000h					
PD43			0000h					
PD44			0000h					
PD45			0000h					
PD46			0000h					
PD47			0000h					
PD48			0000h					

Note 1. Refer to the servo system controller instruction manual for the setting.
2. Used by servo amplifiers with software version A2 or later.

(5) Extension setting 2 parameters ([Pr. PE_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PE01	**FCT1	Fully closed loop function selection 1	0000h					
PE02		For manufacturer setting	0000h					
PE03	*FCT2	Fully closed loop function selection 2	0003h					
PE04	**FBN	Fully closed loop control - Feedback pulse electronic gear 1 - Numerator	1					
PE05	**FBD	Fully closed loop control - Feedback pulse electronic gear 1 - Denominator	1					
PE06	BC1	Fully closed loop control - Speed deviation error detection level	400	[r/min]				
PE07	BC2	Fully closed loop control - Position deviation error detection level	100	[kpulse]				
PE08	DUF	Fully closed loop dual feedback filter	10	[rad/s]				
PE09		For manufacturer setting	0000h					
PE10	FCT3	Fully closed loop function selection 3	0000h					
PE11		For manufacturer setting	0000h					
PE12			0000h					
PE13			0000h					
PE14			0111h					
PE15			20					
PE16			0000h					
PE17			0000h					
PE18			0000h					
PE19			0000h					
PE20			0000h					
PE21			0000h					
PE22			0000h					
PE23			0000h					
PE24			0000h					
PE25			0000h					
PE26			0000h					
PE27			0000h					
PE28			0000h					
PE29			0000h					
PE30			0000h					
PE31			0000h					
PE32			0000h					
PE33			0000h					
PE34	**FBN2	Fully closed loop control - Feedback pulse electronic gear 2 - Numerator	1					
PE35	**FBD2	Fully closed loop control - Feedback pulse electronic gear 2 - Denominator	1					
PE36		For manufacturer setting	0.0					
PE37			0.00					
PE38			0.00					
PE39			20					
PE40			0000h					
PE41	EOP3	Function selection E-3	0000h		○			
PE42		For manufacturer setting	0					
PE43			0.0					
PE44			0000h					
PE45			0000h					
PE46			0000h					
PE47			0000h					
PE48			0000h					
PE49			0000h					
PE50			0000h					

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PE51		For manufacturer setting	0000h					
PE52			0000h					
PE53			0000h					
PE54			0000h					
PE55			0000h					
PE56			0000h					
PE57			0000h					
PE58			0000h					
PE59			0000h					
PE60			0000h					
PE61			0.00					
PE62			0.00					
PE63			0.00					
PE64			0.00					

(6) Extension setting 3 parameters ([Pr. PF_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PF01		For manufacturer setting	0000h					
PF02			0000h					
PF03			0000h					
PF04			0					
PF05			0000h					
PF06	*FOP5	Function selection F-5	0000h		○			
PF07		For manufacturer setting	0000h					
PF08			0000h					
PF09			0					
PF10			0					
PF11			0					
PF12	DBT	Electronic dynamic brake operating time	2000	[ms]	○			
PF13		For manufacturer setting	0000h					
PF14			10					
PF15			0000h					
PF16			0000h					
PF17			0000h					
PF18			0000h					
PF19			0000h					
PF20			0000h					
PF21	DRT	Drive recorder switching time setting	0	[s]	○			
PF22		For manufacturer setting	200					
PF23	OSCL1	Vibration tough drive - Oscillation detection level	50	[%]	○			
PF24	*OSCL2	Vibration tough drive function selection	0000h		○			
PF25	CVAT	SEMI-F47 function - Instantaneous power failure detection time	200	[ms]	○			
PF26		For manufacturer setting	0					
PF27			0					
PF28			0					

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PF29		For manufacturer setting	0000h					
PF30			0					
PF31	FRIC	Machine diagnosis function - Friction judgement speed	0	[r/min]	○			
PF32		For manufacturer setting	50					
PF33			0000h					
PF34			0000h					
PF35			0000h					
PF36			0000h					
PF37			0000h					
PF38			0000h					
PF39			0000h					
PF40			0000h					
PF41			0000h					
PF42			0000h					
PF43			0000h					
PF44			0000h					
PF45			0000h					
PF46			0000h					
PF47			0000h					
PF48			0000h					

(7) Linear servo motor/DD motor setting parameters ([Pr. PL_ _])

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PL01	**LIT1	Linear servo motor/DD motor function selection 1	0301h					
PL02	**LIM	Linear encoder resolution - Numerator	1000	[μm]				
PL03	**LID	Linear encoder resolution - Denominator	1000	[μm]				
PL04	*LIT2	Linear servo motor/DD motor function selection 2	0003h					
PL05	LB1	Position deviation error detection level	0	[mm]/ [0.01rev]				
PL06	LB2	Speed deviation error detection level	0	[r/min]/ [mm/s]				
PL07	LB3	Torque/thrust deviation error detection level	100	[%]				
PL08	*LIT3	Linear servo motor/DD motor function selection 3	0010h					
PL09	LPWM	Magnetic pole detection voltage level	30	[%]				
PL10		For manufacturer setting	5					
PL11			100					
PL12			500					
PL13			0000h					
PL14			0					
PL15			20					
PL16			0					
PL17	LTSTS	Magnetic pole detection - Minute position detection method - Function selection	0000h					
PL18	IDLV	Magnetic pole detection - Minute position detection method - Identification signal amplitude	0	[%]				

No.	Symbol	Name	Initial value	Unit	Operation mode			
					RJ020	Full.	Lin.	DD
PL19		For manufacturer setting	0					
PL20			0					
PL21			0					
PL22			0					
PL23			0000h					
PL24			0					
PL25			0000h					
PL26			0000h					
PL27			0000h					
PL28			0000h					
PL29			0000h					
PL30			0000h					
PL31			0000h					
PL32			0000h					
PL33			0000h					
PL34			0000h					
PL35			0000h					
PL36			0000h					
PL37			0000h					
PL38			0000h					
PL39			0000h					
PL40			0000h					
PL41			0000h					
PL42			0000h					
PL43			0000h					
PL44			0000h					
PL45			0000h					
PL46			0000h					
PL47			0000h					
PL48			0000h					

13.2.2 Detailed list of parameters

POINT

●Set a value to each "x" in the "Setting digit" columns.

(1) Basic setting parameters ([Pr. PA_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA02</td><td>**REG</td><td>Regenerative option
Used to select the regenerative option.
Incorrect setting may cause the regenerative option to burn.
If a selected regenerative option is not for use with the servo amplifier, [AL. 37 Parameter error] occurs.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Regenerative option selection
00: Regenerative option is not used.
・For servo amplifier of 100 W, regenerative option is not used.
・For servo amplifier of 0.2 kW to 7 kW, built-in regenerative resistor is used.
・Supplied regenerative resistors or regenerative option is used with the servo amplifier of 11 kW to 22 kW.
01: FR-RC/FR-RC-H/FR-CV/FR-CV-H/FR-BU2/FR-BU2-H
When you use them, select "Mode 2 (_ _ _ 1)" of "Undervoltage alarm detection mode selection" in [Pr. PC20].
02: MR-RB032
03: MR-RB12
04: MR-RB32
05: MR-RB30
06: MR-RB50 (Cooling fan is required.)
08: MR-RB31
09: MR-RB51 (Cooling fan is required.)
0B: MR-RB3N
0C: MR-RB5N (Cooling fan is required.)
80: MR-RB1H-4
81: MR-RB3M-4 (Cooling fan is required.)
82: MR-RB3G-4 (Cooling fan is required.)
83: MR-RB5G-4 (Cooling fan is required.)
84: MR-RB34-4 (Cooling fan is required.)
85: MR-RB54-4 (Cooling fan is required.)
91: MR-RB3U-4 (Cooling fan is required.)
92: MR-RB5U-4 (Cooling fan is required.)
FA: When the supplied regenerative resistor or a regenerative option used with the servo amplifier of 11 kW to 22 kW is cooled by a cooling fan to increase regenerative ability.</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table></td><td>Refer to Name and function column.</td><td></td></tr>
</table>

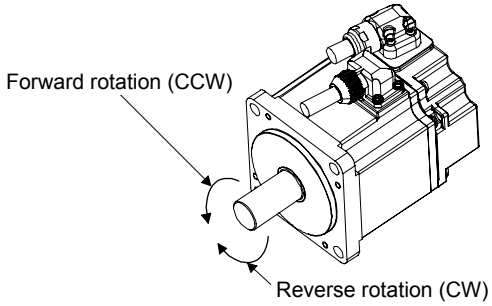
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA03</td><td>*ABS</td><td>Absolute position detection system
Set this parameter when using the absolute position detection system. The parameter is not available in the speed control mode and torque control mode.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Absolute position detection system selection
0: Disabled (used in incremental system)
1: Enabled (used in absolute position detection system)</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA04</td><td>*AOP1</td><td>Function selection A-1
This is used to select the forced stop input and forced stop deceleration function.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>0h</td></tr><tr><td>_ x _ _</td><td>Servo forced stop selection
0: Enabled (The forced stop input EM2 or EM1 is used.)
1: Disabled (The forced stop input EM2 and EM1 are not used.)
Refer to table 13.1 for details.</td><td>0h</td></tr><tr><td>x _ _ _</td><td>Forced stop deceleration function selection
0: Forced stop deceleration function disabled (EM1)
2: Forced stop deceleration function enabled (EM2)
Refer to table 13.1 for details.</td><td>2h</td></tr></table>Table 13.1 Deceleration method
<table><tr><th rowspan="2">Setting value</th><th rowspan="2">EM2/EM1</th><th colspan="2">Deceleration method</th></tr><tr><th>EM2 or EM1 is off</th><th>Alarm occurred</th></tr><tr><td>0 0 _ _</td><td>EM1</td><td>MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.</td><td>MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.</td></tr><tr><td>2 0 _ _</td><td>EM2</td><td>MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.</td><td>MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.</td></tr><tr><td>0 1 _ _</td><td>Not using EM2 or EM1</td><td></td><td>MBR (Electromagnetic brake interlock) turns off without the forced stop deceleration.</td></tr><tr><td>2 1 _ _</td><td>Not using EM2 or EM1</td><td></td><td>MBR (Electromagnetic brake interlock) turns off after the forced stop deceleration.</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA08</td><td>ATU</td><td>Auto tuning mode
Select the gain adjustment mode.

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Gain adjustment mode selection
0: 2 gain adjustment mode 1 (interpolation mode)
1: Auto tuning mode 1
2: Auto tuning mode 2
3: Manual mode
4: 2 gain adjustment mode 2
Refer to table 13.2 for details.</td><td>1h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>

Table 13.2 Gain adjustment mode selection
<table>
<tr><th>Setting value</th><th>Gain adjustment mode</th><th>Automatically adjusted parameter</th></tr>
<tr><td>_ _ _ 0</td><td>2 gain adjustment mode 1 (interpolation mode)</td><td>[Pr. PB06 Load to motor inertia ratio]
[Pr. PB08 Position loop gain]
[Pr. PB09 Speed loop gain]
[Pr. PB10 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 1</td><td>Auto tuning mode 1</td><td>[Pr. PB06 Load to motor inertia ratio]
[Pr. PB07 Model loop gain]
[Pr. PB08 Position loop gain]
[Pr. PB09 Speed loop gain]
[Pr. PB10 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 2</td><td>Auto tuning mode 2</td><td>[Pr. PB07 Model loop gain]
[Pr. PB08 Position loop gain]
[Pr. PB09 Speed loop gain]
[Pr. PB10 Speed integral compensation]</td></tr>
<tr><td>_ _ _ 3</td><td>Manual mode</td><td></td></tr>
<tr><td>_ _ _ 4</td><td>2 gain adjustment mode 2</td><td>[Pr. PB08 Position loop gain]
[Pr. PB09 Speed loop gain]
[Pr. PB10 Speed integral compensation]</td></tr>
</table>
</td><td>Refer to Name and function column.</td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA09</td><td>RSP</td><td>Auto tuning response
Set a response of the auto tuning.
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>1</td><td rowspan="20">Low response
↑
↓
Middle response</td><td>2.7</td></tr>
<tr><td>2</td><td>3.6</td></tr>
<tr><td>3</td><td>4.9</td></tr>
<tr><td>4</td><td>6.6</td></tr>
<tr><td>5</td><td>10.0</td></tr>
<tr><td>6</td><td>11.3</td></tr>
<tr><td>7</td><td>12.7</td></tr>
<tr><td>8</td><td>14.3</td></tr>
<tr><td>9</td><td>16.1</td></tr>
<tr><td>10</td><td>18.1</td></tr>
<tr><td>11</td><td>20.4</td></tr>
<tr><td>12</td><td>23.0</td></tr>
<tr><td>13</td><td>25.9</td></tr>
<tr><td>14</td><td>29.2</td></tr>
<tr><td>15</td><td>32.9</td></tr>
<tr><td>16</td><td>37.0</td></tr>
<tr><td>17</td><td>41.7</td></tr>
<tr><td>18</td><td>47.0</td></tr>
<tr><td>19</td><td>52.9</td></tr>
<tr><td>20</td><td>59.6</td></tr>
</table>
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>21</td><td rowspan="20">Middle response
↑
↓
High response</td><td>67.1</td></tr>
<tr><td>22</td><td>75.6</td></tr>
<tr><td>23</td><td>85.2</td></tr>
<tr><td>24</td><td>95.9</td></tr>
<tr><td>25</td><td>108.0</td></tr>
<tr><td>26</td><td>121.7</td></tr>
<tr><td>27</td><td>137.1</td></tr>
<tr><td>28</td><td>154.4</td></tr>
<tr><td>29</td><td>173.9</td></tr>
<tr><td>30</td><td>195.9</td></tr>
<tr><td>31</td><td>220.6</td></tr>
<tr><td>32</td><td>248.5</td></tr>
<tr><td>33</td><td>279.9</td></tr>
<tr><td>34</td><td>315.3</td></tr>
<tr><td>35</td><td>355.1</td></tr>
<tr><td>36</td><td>400.0</td></tr>
<tr><td>37</td><td>446.6</td></tr>
<tr><td>38</td><td>501.2</td></tr>
<tr><td>39</td><td>571.5</td></tr>
<tr><td>40</td><td>642.7</td></tr>
</table>
</td><td>16</td><td>1
to
40</td></tr>
<tr><td>PA10</td><td>INP</td><td>In-position range
Set an in-position range per command pulse.</td><td>1600
[pulse]</td><td>0
to
65535</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA14</td><td>*POL</td><td>Rotation direction selection
Select the rotation direction of command input pulse.
For the setting for the master-slave operation function, refer to section 17.2 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".
<table><tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr><tr><th>Positioning address increase</th><th>Positioning address decrease</th></tr><tr><td>0</td><td>CCW</td><td>CW</td></tr><tr><td>1</td><td>CW</td><td>CCW</td></tr></table>The following shows the servo motor rotation directions.
  </td><td>0</td><td>0
to
1</td></tr>
<tr><td>PA15</td><td>*ENR</td><td>Encoder output pulses
Set the encoder output pulses from the servo amplifier by using the number of output pulses per revolution, dividing ratio, or electronic gear ratio. (after multiplication by 4)
To set a numerator of the electronic gear, select "A-phase/B-phase pulse electronic gear setting (_ _ 3 _)" of "Encoder output pulse setting selection" in [Pr. PC03].
The maximum output frequency is 4.6 Mpulses/s. Set the parameter within this range.</td><td>4000 [pulse/ rev]</td><td>1
to
65535</td></tr>
<tr><td>PA16</td><td>*ENR2</td><td>Encoder output pulses 2
Set a denominator of the electronic gear for the A/B-phase pulse output. To set a denominator of the electronic gear, select "A-phase/B-phase pulse electronic gear setting (_ _ 3 _)" of "Encoder output pulse setting selection" in [Pr. PC03].</td><td>1</td><td>1
to
65535</td></tr>
<tr><td>PA19</td><td>*BLK</td><td>Parameter writing inhibit
Select a reference range and writing range of the parameter.
Refer to table 13.3 for settings.
Table 13.3 [Pr. PA19] setting value and reading/writing range
<table><tr><th>PA19</th><th>Setting operation</th><th>PA</th><th>PB</th><th>PC</th><th>PD</th><th>PF</th></tr><tr><td rowspan="2">Other than below</td><td>Reading</td><td>○</td><td></td><td></td><td></td><td></td></tr><tr><td>Writing</td><td>○</td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="2">000Ah</td><td>Reading</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr><tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="2">000Bh</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr><tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr><tr><td rowspan="2">000Ch</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr><tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr><tr><td rowspan="2">00ABh (initial value)</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td rowspan="2">100Bh</td><td>Reading</td><td>○</td><td></td><td></td><td></td><td></td></tr><tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="2">100Ch</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr><tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr><tr><td rowspan="2">10ABh</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td></tr></table></td><td>00ABh</td><td>Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA20</td><td>*TDS</td><td>Tough drive setting
Alarms may not be avoided with the tough drive function depending on the situations of the power supply and load fluctuation.
You can assign MTTR (During tough drive) to pins CN3-9, CN3-13, and CN3-15 with [Pr. PD07] to [Pr. PD09].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Vibration tough drive selection
0: Disabled
1: Enabled

Selecting "1" enables to suppress vibrations by automatically changing setting values of [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression filter 2] in case that the vibration exceed the value of the oscillation level set in [Pr. PF23].
For details, refer to section 7.3 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>SEMI-F47 function selection
0: Disabled
1: Enabled

Selecting "1" enables to avoid triggering [AL. 10 Undervoltage] using the electrical energy charged in the capacitor in case that an instantaneous power failure occurs during operation. In [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time], set the time until the occurrence of [AL. 10.1 Voltage drop in the control circuit power].</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA21</td><td>*AOP3</td><td>Function selection A-3
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>One-touch tuning function selection
0: Disabled
1: Enabled

When the digit is "0", the one-touch tuning with MR Configurator2 will be disabled.</td><td>1h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA22</td><td>**PCS</td><td>Position control composition selection
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td></td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>Scale measurement mode selection
0: Disabled
1: Used in absolute position detection system
2: Used in incremental system

The absolute position detection system cannot be used while an incremental type encoder is used. Enabling absolute position detection system will trigger [AL. 37 Parameter error].
However, setting "1" or "2" will trigger [AL. 37 Parameter error] because this function is available in the future.</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PA23</td><td>DRAT</td><td>Drive recorder arbitrary alarm trigger setting
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Alarm detail No. setting
Set the digits when you execute the trigger with arbitrary alarm detail No. for the drive recorder function.
When these digits are "0 0", only the arbitrary alarm No. setting will be enabled.</td><td>00h</td></tr>
<tr><td>x x _ _</td><td>Alarm No. setting
Set the digits when you execute the trigger with arbitrary alarm No. for the drive recorder function.
When "0 0" are set, arbitrary alarm trigger of the drive recorder will be disabled.</td><td>00h</td></tr>
</table>
Setting example:
To activate the drive recorder when [AL. 50 Overload 1] occurs, set "5 0 0 0".
To activate the drive recorder when [AL. 50.3 Thermal overload error 4 during operation] occurs, set "5 0 0 3".</td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA24</td><td>AOP4</td><td>Function selection A-4
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Vibration suppression mode selection
0: Standard mode
1: 3 inertia mode
2: Low response mode
When two low resonance frequencies are generated, select "3 inertia mode (_ _ _ 1)". When the load to motor inertia ratio exceeds the recommended load to motor inertia ratio, select "Low response mode (_ _ _ 2)".
When you select the standard mode or low response mode, "Vibration suppression control 2" is not available.
When you select the 3 inertia mode, the feed forward gain is not available.
Before changing the control mode with the controller during the 3 inertia mode or low response mode, stop the motor.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PA25</td><td>OTHOV</td><td>One-touch tuning - Overshoot permissible level
Set a permissible value of overshoot amount for one-touch tuning as a percentage of the in-position range.
However, setting "0" will be 50%.</td><td>0
[%]</td><td>0
to
100</td></tr>
<tr><td>PA26</td><td>*AOP5</td><td>Function selection A-5
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Torque limit function selection at instantaneous power failure
0: Disabled
1: Enabled
When an instantaneous power failure occurs during operation, you can save electric energy charged in the capacitor in the servo amplifier by limiting torque at acceleration. You can also delay the time until [AL. 10.2 Voltage drop in the main circuit power] occurs with instantaneous power failure tough drive function. Doing this will enable you to set a longer time in [Pr. PF25 SEMI-F47 function - Instantaneous power failure detection time].
The torque limit function at instantaneous power failure is enabled when "SEMI-F47 function selection" in [Pr. PA20] is "Enabled (_ 1 _ _)".</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

(2) Gain/filter setting parameters ([Pr. PB_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB01</td><td>FILT</td><td>Adaptive tuning mode (adaptive filter II)
Set the adaptive filter tuning.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Filter tuning mode selection
Select the adjustment mode of the machine resonance suppression filter 1. For details, refer to section 7.1.2 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".
0: Disabled
1: Automatic setting
2: Manual setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PB02</td><td>VRFT</td><td>Vibration suppression control tuning mode (advanced vibration suppression control II)
This is used to set the vibration suppression control tuning. For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Vibration suppression control 1 tuning mode selection
Select the tuning mode of the vibration suppression control 1.
0: Disabled
1: Automatic setting
2: Manual setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>Vibration suppression control 2 tuning mode selection
Select the tuning mode of the vibration suppression control 2. To enable the digit, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24 Function selection A-4].
0: Disabled
1: Automatic setting
2: Manual setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PB03</td><td>TFBGN</td><td>Torque feedback loop gain
This is used to set a torque feedback loop gain in the continuous operation to torque control mode.
Decreasing the setting value will also decrease a collision load during continuous operation to torque control mode.
Setting a value less than 6 rad/s will be 6 rad/s.</td><td>18000 [rad/s]</td><td>0 to 18000</td></tr>
<tr><td>PB04</td><td>FFC</td><td>Feed forward gain
Set the feed forward gain.
When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1 s or more as the acceleration time constant up to the rated speed.</td><td>0 [%]</td><td>0 to 100</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB06</td><td>GD2</td><td>Load to motor inertia ratio
This is used to set the load to motor inertia ratio.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details. When the parameter is automatic setting, the value will vary between 0.00 and 100.00.
<table><tr><th>Pr. PA08</th><th>This parameter</th></tr><tr><td>_ _ _ 0 (2 gain adjustment mode 1 (interpolation mode))</td><td rowspan="2">Automatic setting</td></tr><tr><td>_ _ _ 1 (Auto tuning mode 1)</td></tr><tr><td>_ _ _ 2 (Auto tuning mode 2)</td><td rowspan="3">Manual setting</td></tr><tr><td>_ _ _ 3 (Manual mode)</td></tr><tr><td>_ _ _ 4 (2 gain adjustment mode 2)</td></tr></table></td><td>7.00
[Multiplier]</td><td>0.00
to
300.00</td></tr>
<tr><td>PB07</td><td>PG1</td><td>Model loop gain
Set the response gain up to the target position.
Increasing the setting value will also increase the response level to the position command but will be liable to generate vibration and/or noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details.
<table><tr><th>Pr. PA08</th><th>This parameter</th></tr><tr><td>_ _ _ 0 (2 gain adjustment mode 1 (interpolation mode))</td><td>Manual setting</td></tr><tr><td>_ _ _ 1 (Auto tuning mode 1)</td><td rowspan="2">Automatic setting</td></tr><tr><td>_ _ _ 2 (Auto tuning mode 2)</td></tr><tr><td>_ _ _ 3 (Manual mode)</td><td>Manual setting</td></tr><tr><td>_ _ _ 4 (2 gain adjustment mode 2)</td><td></td></tr></table></td><td>15.0
[rad/s]</td><td>1.0
to
2000.0</td></tr>
<tr><td>PB08</td><td>PG2</td><td>Position loop gain
This is used to set the gain of the position loop.
Set this parameter to increase the position response to level load disturbance.
Increasing the setting value will also increase the response level to the load disturbance but will be liable to generate vibration and/or noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the following table for details.
<table><tr><th>Pr. PA08</th><th>This parameter</th></tr><tr><td>_ _ _ 0 (2 gain adjustment mode 1 (interpolation mode))</td><td rowspan="3">Automatic setting</td></tr><tr><td>_ _ _ 1 (Auto tuning mode 1)</td></tr><tr><td>_ _ _ 2 (Auto tuning mode 2)</td></tr><tr><td>_ _ _ 3 (Manual mode)</td><td>Manual setting</td></tr><tr><td>_ _ _ 4 (2 gain adjustment mode 2)</td><td>Automatic setting</td></tr></table></td><td>37.0
[rad/s]</td><td>1.0
to
2000.0</td></tr>
<tr><td>PB09</td><td>VG2</td><td>Speed loop gain
This is used to set the gain of the speed loop.
Set this parameter when vibration occurs on machines of low rigidity or large backlash.
Increasing the setting value will also increase the response level but will be liable to generate vibration and/or noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the table of [Pr. PB08] for details.</td><td>823
[rad/s]</td><td>20
to
65535</td></tr>
<tr><td>PB10</td><td>VIC</td><td>Speed integral compensation
This is used to set the integral time constant of the speed loop.
Decreasing the setting value will increase the response level but will be liable to generate vibration and/or noise.
The setting of the parameter will be the automatic setting or manual setting depending on the [Pr. PA08] setting. Refer to the table of [Pr. PB08] for details.</td><td>33.7
[ms]</td><td>0.1
to
1000.0</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB11</td><td>VDC</td><td>Speed differential compensation
This is used to set the differential compensation.
To enable the parameter, select "Continuous PID control enabled (_ _ 3 _)" of "PI-PID switching control selection" in [Pr. PB24].</td><td>980</td><td>0
to
1000</td></tr>
<tr><td>PB12</td><td>OVA</td><td>Overshoot amount compensation
This is used to set a viscous friction torque in percentage to the rated torque at servo motor rated speed.
When the response level is low, or when the torque is limited, the efficiency of the parameter may be lower.</td><td>0
[%]</td><td>0
to
100</td></tr>
<tr><td>PB13</td><td>NH1</td><td>Machine resonance suppression filter 1
Set the notch frequency of the machine resonance suppression filter 1.
When you select "Automatic setting (_ _ _ 1)" of "Filter tuning mode selection" in [Pr. PB01], this parameter will be adjusted automatically.
When you select "Manual setting (_ _ _ 2)" of "Filter tuning mode selection" in [Pr. PB01], the setting value will be enabled.</td><td>4500
[Hz]</td><td>10
to
4500</td></tr>
<tr><td>PB14</td><td>NHQ1</td><td>Notch shape selection 1
Set the shape of the machine resonance suppression filter 1.
When you select "Automatic setting (_ _ _ 1)" of "Filter tuning mode selection" in [Pr. PB01], this parameter will be adjusted automatically.
Set manually for the manual setting.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB15</td><td>NH2</td><td>Machine resonance suppression filter 2
Set the notch frequency of the machine resonance suppression filter 2.
To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 2 selection" in [Pr. PB16].</td><td>4500
[Hz]</td><td>10
to
4500</td></tr>
<tr><td>PB16</td><td>NHQ2</td><td>Notch shape selection 2
Set the shape of the machine resonance suppression filter 2.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Machine resonance suppression filter 2 selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB17</td><td>NHF</td><td>Shaft resonance suppression filter
This is used for setting the shaft resonance suppression filter.
This is used to suppress a low-frequency machine vibration.
When you select "Automatic setting (_ _ _ 0)" of "Shaft resonance suppression filter selection" in [Pr. PB23], the value will be calculated automatically from the servo motor you use and load to motor inertia ratio. Set manually for "Manual setting (_ _ _ 1)".
When "Shaft resonance suppression filter selection" is "Disabled (_ _ _ 2)" in [Pr. PB23], the setting value of this parameter will be disabled.
When you select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49], the shaft resonance suppression filter is not available.

<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ x x</td><td>Shaft resonance suppression filter setting frequency selection
This is used for setting the shaft resonance suppression filter.
Refer to table 13.4 for settings.
Set the value closest to the frequency you need.</td><td>00h</td></tr><tr><td>_ x _ _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr><tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr></table>
Table 13.4 Shaft resonance suppression filter setting frequency selection
<table><tr><th>Setting value</th><th>Frequency [Hz]</th><th>Setting value</th><th>Frequency [Hz]</th></tr><tr><td>00</td><td>Disabled</td><td>10</td><td>562</td></tr><tr><td>01</td><td>Disabled</td><td>11</td><td>529</td></tr><tr><td>02</td><td>4500</td><td>12</td><td>500</td></tr><tr><td>03</td><td>3000</td><td>13</td><td>473</td></tr><tr><td>04</td><td>2250</td><td>14</td><td>450</td></tr><tr><td>05</td><td>1800</td><td>15</td><td>428</td></tr><tr><td>06</td><td>1500</td><td>16</td><td>409</td></tr><tr><td>07</td><td>1285</td><td>17</td><td>391</td></tr><tr><td>08</td><td>1125</td><td>18</td><td>375</td></tr><tr><td>09</td><td>1000</td><td>19</td><td>360</td></tr><tr><td>0A</td><td>900</td><td>1A</td><td>346</td></tr><tr><td>0B</td><td>818</td><td>1B</td><td>333</td></tr><tr><td>0C</td><td>750</td><td>1C</td><td>321</td></tr><tr><td>0D</td><td>692</td><td>1D</td><td>310</td></tr><tr><td>0E</td><td>642</td><td>1E</td><td>300</td></tr><tr><td>0F</td><td>600</td><td>1F</td><td>290</td></tr></table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PB18</td><td>LPF</td><td>Low-pass filter setting
Set the low-pass filter.
The following shows a relation of a required parameter to this parameter.

<table><tr><th>[Pr. PB23]</th><th>[Pr. PB18]</th></tr><tr><td>_ _ 0 _ (Initial value)</td><td>Automatic setting</td></tr><tr><td>_ _ 1 _</td><td>Setting value enabled</td></tr><tr><td>_ _ 2 _</td><td>Setting value disabled</td></tr></table></td><td>3141 [rad/s]</td><td>100 to 18000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>PB19</td><td>VRF11</td><td>Vibration suppression control 1 - Vibration frequency
Set the vibration frequency for vibration suppression control 1 to suppress low-frequency machine vibration.
When "Vibration suppression control 1 tuning mode selection" is "Automatic setting (_ _ _ 1)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (_ _ _ 2)". For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>100.0 [Hz]</td><td>0.1 to 300.0</td></tr>
<tr><td>PB20</td><td>VRF12</td><td>Vibration suppression control 1 - Resonance frequency
Set the resonance frequency for vibration suppression control 1 to suppress low-frequency machine vibration.
When "Vibration suppression control 1 tuning mode selection" is "Automatic setting (_ _ _ 1)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (_ _ _ 2)". For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>100.0 [Hz]</td><td>0.1 to 300.0</td></tr>
<tr><td>PB21</td><td>VRF13</td><td>Vibration suppression control 1 - Vibration frequency damping
Set a damping of the vibration frequency for vibration suppression control 1 to suppress low-frequency machine vibration.
When "Vibration suppression control 1 tuning mode selection" is "Automatic setting (_ _ _ 1)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (_ _ _ 2)". For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>0.00</td><td>0.00 to 0.30</td></tr>
<tr><td>PB22</td><td>VRF14</td><td>Vibration suppression control 1 - Resonance frequency damping
Set a damping of the resonance frequency for vibration suppression control 1 to suppress low-frequency machine vibration.
When "Vibration suppression control 1 tuning mode selection" is "Automatic setting (_ _ _ 1)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (_ _ _ 2)". For details, refer to section 7.1.5 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual".</td><td>0.00</td><td>0.00 to 0.30</td></tr>
<tr><td>PB23</td><td>VFBF</td><td>Low-pass filter selection
Select the shaft resonance suppression filter and low-pass filter.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Shaft resonance suppression filter selection
0: Automatic setting
1: Manual setting
2: Disabled
When you select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49], the shaft resonance suppression filter is not available.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Low-pass filter selection
0: Automatic setting
1: Manual setting
2: Disabled</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>PB24</td><td>*MVS</td><td>Slight vibration suppression control
Select the slight vibration suppression control and PI-PID switching control.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Slight vibration suppression control selection
0: Disabled
1: Enabled
To enable the slight vibration suppression control, select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08]. Slight vibration suppression control cannot be used in the speed control mode.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>PI-PID switching control selection
0: PI control enabled
(Switching to PID control is possible with commands of servo system controller.)
3: Continuous PID control enabled
If the servo motor at a stop is rotated even one pulse due to any external factor, it generates torque to compensate for a position shift. When the servo motor shaft is to be locked mechanically after positioning completion (stop), switching on the PC (Proportion control) upon positioning completion will suppress the unnecessary torque generated to compensate for a position shift.</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB26</td><td>*CDP</td><td>Gain switching function
Select the gain switching condition.
Set conditions to enable the gain switching values set in [Pr. PB29] to [Pr. PB36] and [Pr. PB56] to [Pr. PB60].
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Gain switching selection
0: Disabled
1: Control command from controller is enabled
2: Command frequency
3: Droop pulses
4: Servo motor speed</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Gain switching condition selection
0: Gain after switching is enabled with gain switching condition or more
1: Gain after switching is enabled with gain switching condition or less</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PB27</td><td>CDL</td><td>Gain switching condition
This is used to set the value of gain switching (command frequency, droop pulses, and servo motor speed) selected in [Pr. PB26].
The set value unit differs depending on the switching condition item. (Refer to "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual" section 7.2.3.)</td><td>10
[kpulse/s]
/[pulse]
/[r/min]</td><td>0
to
65535</td></tr>
<tr><td>PB28</td><td>CDT</td><td>Gain switching time constant
This is used to set the time constant at which the gains will change in response to the conditions set in [Pr. PB26] and [Pr. PB27].</td><td>1
[ms]</td><td>0
to
100</td></tr>
<tr><td>PB29</td><td>GD2B</td><td>Load to motor inertia ratio after gain switching
This is used to set the load to motor inertia ratio when gain switching is enabled.
This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08].</td><td>7.00
[Multiplier]</td><td>0.00
to
300.00</td></tr>
</table>

No.	Symbol	Name and function	Initial value [Unit]	Setting range
PB30	PG2B	Position loop gain after gain switching Set the position loop gain when the gain switching is enabled. When you set a value less than 1.0 rad/s, the value will be the same as [Pr. PB08]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08].	0.0 [rad/s]	0.0 to 2000.0
PB31	VG2B	Speed loop gain after gain switching Set the speed loop gain when the gain switching is enabled. When you set a value less than 20 rad/s, the value will be the same as [Pr. PB09]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08].	0 [rad/s]	0 to 65535
PB32	VICB	Speed integral compensation after gain switching Set the speed integral compensation when the gain changing is enabled. When you set a value less than 0.1 ms, the value will be the same as [Pr. PB10]. This parameter is enabled only when you select "Manual mode (_ _ _ 3)" of "Gain adjustment mode selection" in [Pr. PA08].	0.0 [ms]	0.0 to 5000.0
PB33	VRF11B	Vibration suppression control 1 - Vibration frequency after gain switching Set the vibration frequency for vibration suppression control 1 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB19]. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0
PB34	VRF12B	Vibration suppression control 1 - Resonance frequency after gain switching Set the resonance frequency for vibration suppression control 1 when the gain switching is enabled. When you set a value less than 0.1 Hz, the value will be the same as [Pr. PB20]. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0
PB35	VRF13B	Vibration suppression control 1 - Vibration frequency damping after gain switching Set a damping of the vibration frequency for vibration suppression control 1 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30
PB36	VRF14B	Vibration suppression control 1 - Resonance frequency damping after gain switching Set a damping of the resonance frequency for vibration suppression control 1 when the gain switching is enabled. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 1 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ _ 2)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>PB45</td><td>CNHF</td><td>Command notch filter
Set the command notch filter.

<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ x x</td><td>Command notch filter setting frequency selection
Refer to table 13.5 for the relation of setting values to frequency.</td><td>00h</td></tr><tr><td>_ x _ _</td><td>Notch depth selection
Refer to table 13.6 for details.</td><td>0h</td></tr><tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr></table>
Table 13.5 Command notch filter setting frequency selection
<table><tr><th>Setting value</th><th>Frequency [Hz]</th><th>Setting value</th><th>Frequency [Hz]</th><th>Setting value</th><th>Frequency [Hz]</th></tr><tr><td>00</td><td>Disabled</td><td>20</td><td>70</td><td>40</td><td>17.6</td></tr><tr><td>01</td><td>2250</td><td>21</td><td>66</td><td>41</td><td>16.5</td></tr><tr><td>02</td><td>1125</td><td>22</td><td>62</td><td>42</td><td>15.6</td></tr><tr><td>03</td><td>750</td><td>23</td><td>59</td><td>43</td><td>14.8</td></tr><tr><td>04</td><td>562</td><td>24</td><td>56</td><td>44</td><td>14.1</td></tr><tr><td>05</td><td>450</td><td>25</td><td>53</td><td>45</td><td>13.4</td></tr><tr><td>06</td><td>375</td><td>26</td><td>51</td><td>46</td><td>12.8</td></tr><tr><td>07</td><td>321</td><td>27</td><td>48</td><td>47</td><td>12.2</td></tr><tr><td>08</td><td>281</td><td>28</td><td>46</td><td>48</td><td>11.7</td></tr><tr><td>09</td><td>250</td><td>29</td><td>45</td><td>49</td><td>11.3</td></tr><tr><td>0A</td><td>225</td><td>2A</td><td>43</td><td>4A</td><td>10.8</td></tr><tr><td>0B</td><td>204</td><td>2B</td><td>41</td><td>4B</td><td>10.4</td></tr><tr><td>0C</td><td>187</td><td>2C</td><td>40</td><td>4C</td><td>10</td></tr><tr><td>0D</td><td>173</td><td>2D</td><td>38</td><td>4D</td><td>9.7</td></tr><tr><td>0E</td><td>160</td><td>2E</td><td>37</td><td>4E</td><td>9.4</td></tr><tr><td>0F</td><td>150</td><td>2F</td><td>36</td><td>4F</td><td>9.1</td></tr><tr><td>10</td><td>140</td><td>30</td><td>35.2</td><td>50</td><td>8.8</td></tr><tr><td>11</td><td>132</td><td>31</td><td>33.1</td><td>51</td><td>8.3</td></tr><tr><td>12</td><td>125</td><td>32</td><td>31.3</td><td>52</td><td>7.8</td></tr><tr><td>13</td><td>118</td><td>33</td><td>29.6</td><td>53</td><td>7.4</td></tr><tr><td>14</td><td>112</td><td>34</td><td>28.1</td><td>54</td><td>7.0</td></tr><tr><td>15</td><td>107</td><td>35</td><td>26.8</td><td>55</td><td>6.7</td></tr><tr><td>16</td><td>102</td><td>36</td><td>25.6</td><td>56</td><td>6.4</td></tr><tr><td>17</td><td>97</td><td>37</td><td>24.5</td><td>57</td><td>6.1</td></tr><tr><td>18</td><td>93</td><td>38</td><td>23.4</td><td>58</td><td>5.9</td></tr><tr><td>19</td><td>90</td><td>39</td><td>22.5</td><td>59</td><td>5.6</td></tr><tr><td>1A</td><td>86</td><td>3A</td><td>21.6</td><td>5A</td><td>5.4</td></tr><tr><td>1B</td><td>83</td><td>3B</td><td>20.8</td><td>5B</td><td>5.2</td></tr><tr><td>1C</td><td>80</td><td>3C</td><td>20.1</td><td>5C</td><td>5.0</td></tr><tr><td>1D</td><td>77</td><td>3D</td><td>19.4</td><td>5D</td><td>4.9</td></tr><tr><td>1E</td><td>75</td><td>3E</td><td>18.8</td><td>5E</td><td>4.7</td></tr><tr><td>1F</td><td>72</td><td>3F</td><td>18.2</td><td>5F</td><td>4.5</td></tr></table></td><td>Refer to Name and function column.</td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB45</td><td>CNHF</td><td>Table 13.6 Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth [dB]</th></tr>
<tr><td>0</td><td>-40.0</td></tr>
<tr><td>1</td><td>-24.1</td></tr>
<tr><td>2</td><td>-18.1</td></tr>
<tr><td>3</td><td>-14.5</td></tr>
<tr><td>4</td><td>-12.0</td></tr>
<tr><td>5</td><td>-10.1</td></tr>
<tr><td>6</td><td>-8.5</td></tr>
<tr><td>7</td><td>-7.2</td></tr>
</table>
<table>
<tr><th>Setting value</th><th>Depth [dB]</th></tr>
<tr><td>8</td><td>-6.0</td></tr>
<tr><td>9</td><td>-5.0</td></tr>
<tr><td>A</td><td>-4.1</td></tr>
<tr><td>B</td><td>-3.3</td></tr>
<tr><td>C</td><td>-2.5</td></tr>
<tr><td>D</td><td>-1.8</td></tr>
<tr><td>E</td><td>-1.2</td></tr>
<tr><td>F</td><td>-0.6</td></tr>
</table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PB46</td><td>NH3</td><td>Machine resonance suppression filter 3
Set the notch frequency of the machine resonance suppression filter 3.
To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 3 selection" in [Pr. PB47].</td><td>4500 [Hz]</td><td>10 to 4500</td></tr>
<tr><td>PB47</td><td>NHQ3</td><td>Notch shape selection 3
Set the shape of the machine resonance suppression filter 3.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Machine resonance suppression filter 3 selection
0: Disabled
1: Enabled</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr>
</table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PB48</td><td>NH4</td><td>Machine resonance suppression filter 4
Set the notch frequency of the machine resonance suppression filter 4.
To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 4 selection" in [Pr. PB49].</td><td>4500 [Hz]</td><td>10 to 4500</td></tr>
</table>

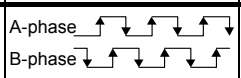
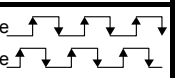
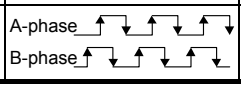
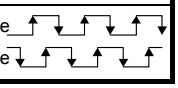
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PB49</td><td>NHQ4</td><td>Notch shape selection 4
Set the shape of the machine resonance suppression filter 4.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Machine resonance suppression filter 4 selection
0: Disabled
1: Enabled
When you select "Enabled" of this digit, [Pr. PB17 Shaft resonance suppression filter] is not available.</td><td>0h</td></tr><tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr><tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr><tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr></table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PB50</td><td>NH5</td><td>Machine resonance suppression filter 5
Set the notch frequency of the machine resonance suppression filter 5.
To enable the setting value, select "Enabled (_ _ _ 1)" of "Machine resonance suppression filter 5 selection" in [Pr. PB51].</td><td>4500 [Hz]</td><td>10 to 4500</td></tr>
<tr><td>PB51</td><td>NHQ5</td><td>Notch shape selection 5
Set the shape of the machine resonance suppression filter 5.
When you select "Enabled (_ _ _ 1)" of "Robust filter selection" in [Pr. PE41], the machine resonance suppression filter 5 is not available.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Machine resonance suppression filter 5 selection
0: Disabled
1: Enabled</td><td>0h</td></tr><tr><td>_ _ x _</td><td>Notch depth selection
0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0h</td></tr><tr><td>_ x _ _</td><td>Notch width selection
0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0h</td></tr><tr><td>x _ _ _</td><td>For manufacturer setting</td><td>0h</td></tr></table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PB52</td><td>VRF21</td><td>Vibration suppression control 2 - Vibration frequency
Set the vibration frequency for vibration suppression control 2 to suppress low-frequency machine vibration.
To enable this, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24].
When "Vibration suppression control 2 tuning mode selection" is "Automatic setting (_ _ 1 _)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (_ _ 2 _)".</td><td>100.0 [Hz]</td><td>0.1 to 300.0</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB53	VRF22	Vibration suppression control 2 - Resonance frequency Set the resonance frequency for vibration suppression control 2 to suppress low-frequency machine vibration. To enable this, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24]. When "Vibration suppression control 2 tuning mode selection" is "Automatic setting (_ _ 1 _)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (_ _ 2 _)".	100.0 [Hz]	0.1 to 300.0
PB54	VRF23	Vibration suppression control 2 - Vibration frequency damping Set a damping of the vibration frequency for vibration suppression control 2 to suppress low-frequency machine vibration. To enable this, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24]. When "Vibration suppression control 2 tuning mode selection" is "Automatic setting (_ _ 1 _)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (_ _ 2 _)".	0.00	0.00 to 0.30
PB55	VRF24	Vibration suppression control 2 - Resonance frequency damping Set a damping of the resonance frequency for vibration suppression control 2 to suppress low-frequency machine vibration. To enable this, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24]. When "Vibration suppression control 2 tuning mode selection" is "Automatic setting (_ _ 1 _)" in [Pr. PB02], this parameter will be set automatically. Set manually for "Manual setting (_ _ 2 _)".	0.00	0.00 to 0.30
PB56	VRF21B	Vibration suppression control 2 - Vibration frequency after gain switching Set the vibration frequency for vibration suppression control 2 when the gain switching is enabled. To enable this, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". • "Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0
PB57	VRF22B	Vibration suppression control 2 - Resonance frequency after gain switching Set the resonance frequency for vibration suppression control 2 when the gain switching is enabled. To enable this, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". • "Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [Hz]	0.0 to 300.0
PB58	VRF23B	Vibration suppression control 2 - Vibration frequency damping after gain switching Set a damping of the vibration frequency for vibration suppression control 2 when the gain switching is enabled. To enable this, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24]. This parameter will be enabled only when the following conditions are fulfilled. • "Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". • "Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". • "Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30

No.	Symbol	Name and function	Initial value [unit]	Setting range
PB59	VRF24B	Vibration suppression control 2 - Resonance frequency damping after gain switching Set a damping of the resonance frequency for vibration suppression control 2 when the gain switching is enabled. To enable this, select "3 inertia mode (_ _ _ 1)" of "Vibration suppression mode selection" in [Pr. PA24]. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Vibration suppression control 2 tuning mode selection" in [Pr. PB02] is "Manual setting (_ _ 2 _)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.00	0.00 to 0.30
PB60	PG1B	Model loop gain after gain switching Set the model loop gain when the gain switching is enabled. When you set a value less than 1.0 rad/s, the value will be the same as [Pr. PB07]. This parameter will be enabled only when the following conditions are fulfilled. ・"Gain adjustment mode selection" in [Pr. PA08] is "Manual mode (_ _ _ 3)". ・"Gain switching selection" in [Pr. PB26] is "Control command from controller is enabled (_ _ _ 1)". Switching during driving may cause a shock. Be sure to switch them after the servo motor stops.	0.0 [rad/s]	0.0 to 2000.0

(3) Extension setting parameters ([Pr. PC_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC01</td><td>ERZ</td><td>Error excessive alarm level
Set an error excessive alarm level.
Set this per rev for rotary servo motors. Setting "0" will be 3 rev. Setting over 200 rev will be clamped at 200 rev.

Note. Setting can be changed in [Pr. PC06].</td><td>0
[rev]
(Note)</td><td>0
to
1000</td></tr>
<tr><td>PC02</td><td>MBR</td><td>Electromagnetic brake sequence output
This is used to set the delay time for the base drive circuit to shut off after MBR (Electromagnetic brake interlock).</td><td>0
[ms]</td><td>0
to
1000</td></tr>
<tr><td>PC03</td><td>*ENRS</td><td>Encoder output pulse selection
This is used to select the encoder pulse direction and encoder output pulse setting.
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Encoder output pulse phase selection
0: Increasing A-phase 90° in CCW
1: Increasing A-phase 90° in CW
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Servo motor rotation direction</th></tr>
<tr><th>CCW</th><th>CW</th></tr>
<tr><td>0</td><td> 
</td><td> 
</td></tr>
<tr><td>1</td><td> 
</td><td> 
</td></tr>
</table></td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Encoder output pulse setting selection
0: Output pulse setting
(When "_ 1 0 _" is set in this parameter, [AL. 37 Parameter error] will occur.)
1: Dividing ratio setting
3: A-phase/B-phase pulse electronic gear setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC04</td><td>**COP1</td><td>Function selection C-1
Select the encoder cable communication method selection.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>Encoder cable communication method selection
0: Two-wire type
1: Four-wire type
Incorrect setting will result in [AL. 16 Encoder initial communication error 1].</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC05</td><td>**COP2</td><td>Function selection C-2
This is used to select the motor-less operation.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Motor-less operation selection
0: Disabled
1: Enabled</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC06</td><td>*COP3</td><td>Function selection C-3
Select the error excessive alarm level unit for the [Pr. PC01] setting. The parameter is not available in the speed control mode and torque control mode.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>Error excessive alarm level unit selection
0: 1 rev unit
1: 01 rev unit
2: 001 rev unit
3: 0001 rev unit</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC07</td><td>ZSP</td><td>Zero speed
Used to set the output range of ZSP (Zero speed detection).
ZSP (Zero speed detection) has hysteresis of 20 r/min.</td><td>50
[r/min]</td><td>0
to
10000</td></tr>
<tr><td>PC08</td><td>OSL</td><td>Overspeed alarm detection level
This is used to set an overspeed alarm detection level.
When you set a value more than "servo motor maximum speed × 120%", the set value will be clamped.
When you set "0", the value of "servo motor maximum speed × 120%" will be set.</td><td>0
[r/min]</td><td>0
to
20000</td></tr>
</table>

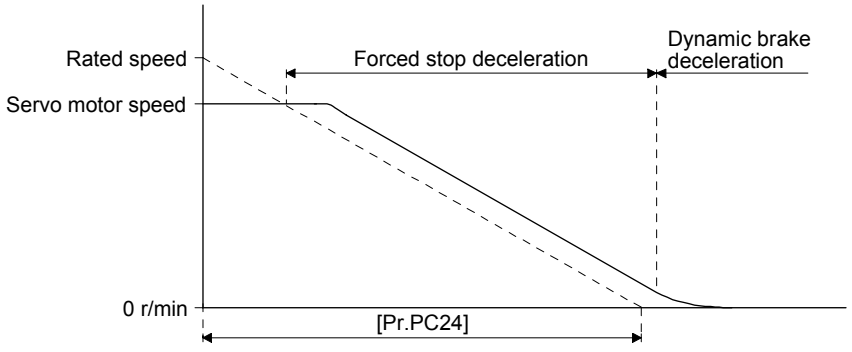
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC09</td><td>MOD1</td><td>Analog monitor 1 output
Select a signal to output to MO1 (Analog monitor 1). Refer to appendix 11 (3) of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual" for the detection point of output selection.

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Analog monitor 1 output selection
Refer to table 13.7 for settings.</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>

Table 13.7 Analog monitor setting value
<table>
<tr><th>Setting value</th><th>Item</th></tr>
<tr><td>00</td><td>Servo motor speed (±8 V/max. speed)</td></tr>
<tr><td>01</td><td>Torque (±8 V/max. torque)</td></tr>
<tr><td>02</td><td>Servo motor speed (+8 V/max. speed)</td></tr>
<tr><td>03</td><td>Torque (+8 V/max. torque)</td></tr>
<tr><td>04</td><td>Current command (±8 V/max. current command)</td></tr>
<tr><td>05</td><td>Speed command (±8 V/max. speed)</td></tr>
<tr><td>06</td><td>Servo motor-side droop pulses (±10 V/100 pulses) (Note)</td></tr>
<tr><td>07</td><td>Servo motor-side droop pulses (±10 V/1000 pulses) (Note)</td></tr>
<tr><td>08</td><td>Servo motor-side droop pulses (±10 V/10000 pulses) (Note)</td></tr>
<tr><td>09</td><td>Servo motor-side droop pulses (±10 V/100000 pulses) (Note)</td></tr>
<tr><td>0A</td><td>Feedback position (±10 V/1 Mpulse) (Note)</td></tr>
<tr><td>0B</td><td>Feedback position (±10 V/10 Mpulses) (Note)</td></tr>
<tr><td>0C</td><td>Feedback position (±10 V/100 Mpulses) (Note)</td></tr>
<tr><td>0D</td><td>Bus voltage (200 V class and 100 V class: +8 V/400 V, 400 V class: +8 V/800 V)</td></tr>
<tr><td>0E</td><td>Speed command 2 (±8 V/max. speed)</td></tr>
<tr><td>17</td><td>Encoder inside temperature (±10 V/±128 ˚C)</td></tr>
</table>

Note. Encoder pulse unit</td><td>Refer to Name and function column.</td><td></td></tr>
</table>

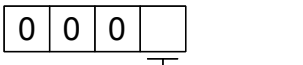
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC10</td><td>MOD2</td><td>Analog monitor 2 output
Select a signal to output to MO2 (Analog monitor 2). Refer to appendix 11 (3) of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual" for the detection point of output selection.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ x x</td><td>Analog monitor 2 output selection
Refer to [Pr. PC09] for settings.</td><td>01h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC11</td><td>MO1</td><td>Analog monitor 1 offset
This is used to set the offset voltage of MO1 (Analog monitor 1).</td><td>0
[mV]</td><td>-999
to
999</td></tr>
<tr><td>PC12</td><td>MO2</td><td>Analog monitor 2 offset
This is used to set the offset voltage of MO2 (Analog monitor 2).</td><td>0
[mV]</td><td>-999
to
999</td></tr>
<tr><td>PC13</td><td>MOSDL</td><td>Analog monitor - Feedback position output standard data - Low
Set a monitor output standard position (lower 4 digits) for the feedback position when selecting "Feedback position" for MO1 (Analog monitor 1) and MO2 (Analog monitor 2).
Monitor output standard position = [Pr. PC14] setting × 10000 + [Pr. PC13] setting</td><td>0
[pulse]</td><td>-9999
to
9999</td></tr>
<tr><td>PC14</td><td>MOSDH</td><td>Analog monitor - Feedback position output standard data - High
Set a monitor output standard position (higher 4 digits) for the feedback position when selecting "Feedback position" for MO1 (Analog monitor 1) and MO2 (Analog monitor 2).
Monitor output standard position = [Pr. PC14] setting × 10000 + [Pr. PC13] setting</td><td>0
[10000 pulses]</td><td>-9999
to
9999</td></tr>
<tr><td>PC17</td><td>**COP4</td><td>Function selection C-4
This is used to select a home position setting condition.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Selection of home position setting condition
0: Need to pass servo motor Z-phase after power on
1: Not need to pass servo motor Z-phase after power on</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC18</td><td>*COP5</td><td>Function selection C-5
This is used to select the [AL. E9 Main circuit off warning] occurrence condition.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>[AL. E9 Main circuit off warning] selection
0: Detection with the ready-on and servo-on command
1: Detection only with the servo-on command</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC20</td><td>*COP7</td><td>Function selection C-7
Select the detection method of [AL. 10 Undervoltage].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Undervoltage alarm detection method selection
Set this parameter when [AL. 10 undervoltage] occurs due to distorted power supply voltage waveform while using FR-RC-(H) or FR-CV-(H).
0: [AL. 10] not occurrence
1: [AL. 10] occurrence</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC21</td><td>*BPS</td><td>Alarm history clear
Used to clear the alarm history.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Alarm history clear selection
0: Disabled
1: Enabled
When you select "Enabled", the alarm history will be cleared at next power-on. After the alarm history is cleared, the setting is automatically disabled.</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC24</td><td>RSBR</td><td>Forced stop deceleration time constant
This is used to set deceleration time constant when you use the forced stop deceleration function.
Set the time taken to reach 0 r/min from the rated speed in ms unit.
 

[Precautions]
・If the servo motor torque is saturated at the maximum torque during forced stop deceleration because the set time is too short, the time to stop will be longer than the set time constant.
・[AL. 50 Overload alarm 1] or [AL. 51 Overload alarm 2] may occur during forced stop deceleration, depending on the set value.
・After an alarm that leads to a forced stop deceleration, if an alarm that does not lead to a forced stop deceleration occurs or if the control circuit power supply is cut, dynamic braking will start regardless of the deceleration time constant setting.
・Set a longer time than deceleration time at quick stop of the controller. If a shorter time is set, [AL. 52 Error excessive] may occur.</td><td>100 [ms]</td><td>0 to 20000</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PC29</td><td>*COPB</td><td>Function selection C-B
This is used to select the POL reflection at torque control.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>POL reflection selection at torque control
0: Enabled
1: Disabled</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PC31</td><td>RSUP1</td><td>Vertical axis freefall prevention compensation amount
Set the compensation amount of the vertical axis freefall prevention function.
Set it in the unit of servo motor rotation amount.
When a positive value is set, compensation is performed to increase the command address.
When a negative value is set, compensation is performed to decrease the command address.
The vertical axis freefall prevention function is performed when all of the following conditions are met.
1) Position control mode
2) The value of the parameter is other than "0".
3) The forced stop deceleration function is enabled.
4) An alarm has occurred or EM2 has turned off when the servo motor speed is zero speed or less.
5) MBR (Electromagnetic brake interlock) was enabled in [Pr. PD07] to [Pr. PD09], and the base circuit shut-off delay time was set in [Pr. PC16].</td><td>0
[0.0001 rev]</td><td>-25000
to
25000</td></tr>
</table>

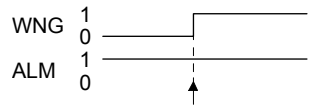
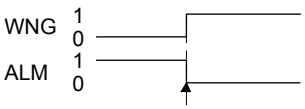
(4) I/O setting parameters ([Pr. PD_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD02</td><td>*DIA2</td><td>Input signal automatic on selection 2
<table>
<tr><th colspan="2">Setting digit</th><th rowspan="2">Explanation</th><th rowspan="2">Initial value</th></tr>
<tr><th>HEX.</th><th>BIN.</th></tr>
<tr><td rowspan="4">_ _ _ x</td><td>_ _ _ x</td><td>FLS (Upper stroke limit) selection
0: Disabled
1: Enabled</td><td rowspan="4">0h</td></tr>
<tr><td>_ _ x _</td><td>RLS (Lower stroke limit) selection
0: Disabled
1: Enabled</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td></tr>
<tr><td>x _ _ _</td></tr>
<tr><td>_ _ x _</td><td rowspan="3"></td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>
Convert the setting value into hexadecimal as follows.


<table>
<tr><th rowspan="2">Signal name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>FLS (Upper stroke limit) selection</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td>RLS (Lower stroke limit) selection</td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
BIN 0: Use for an external input signal.
BIN 1: Automatic on</td><td>Refer to Name and function column.</td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD07</td><td>*DO1</td><td>Output device selection 1
You can assign any output device to the CN3-13 pin. As the initial value, MBR (Electromagnetic brake interlock) is assigned to the pin.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ x x</td><td>Device selection
Refer to table 13.8 for settings.</td><td>05h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table>
Table 13.8 Selectable output devices
<table><tr><th>Setting value</th><th>Output device</th></tr><tr><td>00</td><td>Always off</td></tr><tr><td>02</td><td>RD (Ready)</td></tr><tr><td>03</td><td>ALM (Malfunction)</td></tr><tr><td>04</td><td>INP (In-position)</td></tr><tr><td>05</td><td>MBR (Electromagnetic brake interlock)</td></tr><tr><td>06</td><td>DB (Dynamic brake interlock)</td></tr><tr><td>07</td><td>TLC (Limiting torque)</td></tr><tr><td>08</td><td>WNG (Warning)</td></tr><tr><td>09</td><td>BWNG (Battery warning)</td></tr><tr><td>0A</td><td>SA (Speed reached)</td></tr><tr><td>0C</td><td>ZSP (Zero speed detection)</td></tr><tr><td>0F</td><td>CDPS (Variable gain selection)</td></tr><tr><td>11</td><td>ABSV (Absolute position undetermined)</td></tr><tr><td>17</td><td>MTTR (During tough drive)</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD08</td><td>*DO2</td><td>Output device selection 2
You can assign any output device to the CN3-9 pin. INP (In-position) is assigned as the initial value.
The devices that can be assigned and the setting method are the same as in [Pr. PD07].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ x x</td><td>Device selection
Refer to table 13.8 in [Pr. PD07] for settings.</td><td>04h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD09</td><td>*DO3</td><td>Output device selection 3
You can assign any output device to the CN3-15 pin. ALM (Malfunction) is assigned as the initial value.
The devices that can be assigned and the setting method are the same as in [Pr. PD07].
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ x x</td><td>Device selection
Refer to table 13.8 in [Pr. PD07] for settings.</td><td>03h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD11</td><td>*DIF</td><td>Input filter setting
Select the input filter.
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Input signal filter selection
Refer to the servo system controller instruction manual for the setting.
If external input signal causes chattering due to noise, etc., input filter is used to suppress it.
0: None
1: 0.888 [ms]
2: 1.777 [ms]
3: 2.666 [ms]
4: 3.555 [ms]</td><td>4h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD12</td><td>*DOP1</td><td>Function selection D-1
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>Servo motor thermistor enabled/disabled selection
0: Enabled
1: Disabled
For servo motors without thermistor, the setting will be disabled.
This parameter is used by servo amplifier with software version A1 or later.</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PD14</td><td>*DOP3</td><td>Function selection D-3
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>For manufacturer setting</td><td>0h</td></tr><tr><td>_ _ x _</td><td>Selection of the output device at warning occurrence
Select WNG (Warning) and ALM (Malfunction) output status at warning occurrence.

Servo amplifier output
<table><tr><th>Setting value</th><th>(Note 1) Device status</th></tr><tr><td>0</td><td>  </td></tr><tr><td>1</td><td>  </td></tr></table>Note 1. 0: Off
1: On
2. Although ALM is turned off upon occurrence of the warning, the forced stop deceleration is performed.</td><td>0h</td></tr><tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

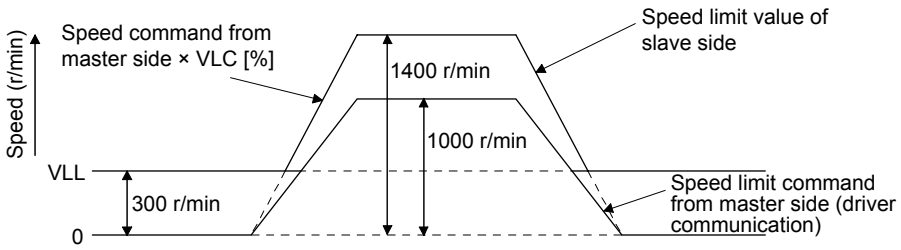
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PD15</td><td>*IDCS</td><td>Driver communication setting
This parameter is supported with software version A2 or later. Check the software version using MR Configurator2.
This parameter is used to select master/slave axis for the driver communication.
This is available only when the deceleration to a stop function is disabled. When the deceleration to a stop function is enabled, [AL. 37] will occur.

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Master axis operation selection
Setting "1" other than in standard control mode will trigger [AL. 37].
0: Disabled (not using master-slave operation function)
1: Enabled (this servo amplifier: master axis)</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>Slave axis operation selection
Setting "1" other than in standard control mode will trigger [AL. 37].
0: Disabled (not using master-slave operation function)
1: Enabled (this servo amplifier: slave axis)</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table>

<table>
<tr><th colspan="2">Master-slave operation function</th><th>Setting value</th></tr>
<tr><td>Not used</td><td></td><td>0000</td></tr>
<tr><td rowspan="2">Used</td><td>Master</td><td>0001</td></tr>
<tr><td>Slave</td><td>0010</td></tr>
</table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PD16</td><td>*MD1</td><td>Driver communication setting - Master - Transmit data selection 1
This parameter is supported with software version A2 or later. Check the software version using MR Configurator2.
This parameter is used to select transmit data from master axis to slave axis.
When setting this amplifier as master axis ([Pr. PD15] is "_ _ 0 1".), select "_ _ 3 8 (torque command)" with this parameter.

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Transmission data selection
00: Disabled
38: Torque command</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td>Refer to Name and function column.</td><td></td></tr>
<tr><td>PD17</td><td>*MD2</td><td>Driver communication setting - Master - Transmit data selection 2
This parameter is supported with software version A2 or later. Check the software version using MR Configurator2.
This parameter is used to select transmit data from master axis to slave axis.
When setting this amplifier as master axis ([Pr. PD15] is "_ _ 0 1".), select "_ _ 3 A (speed limit command)" with this parameter.

<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ x x</td><td>Transmission data selection
00: Disabled
3A: speed limit command</td><td>00h</td></tr>
<tr><td>_ x _ _</td><td rowspan="2">For manufacturer setting</td><td>0h</td></tr>
<tr><td>x _ _ _</td><td>0h</td></tr>
</table></td><td>Refer to Name and function column.</td><td></td></tr>
</table>

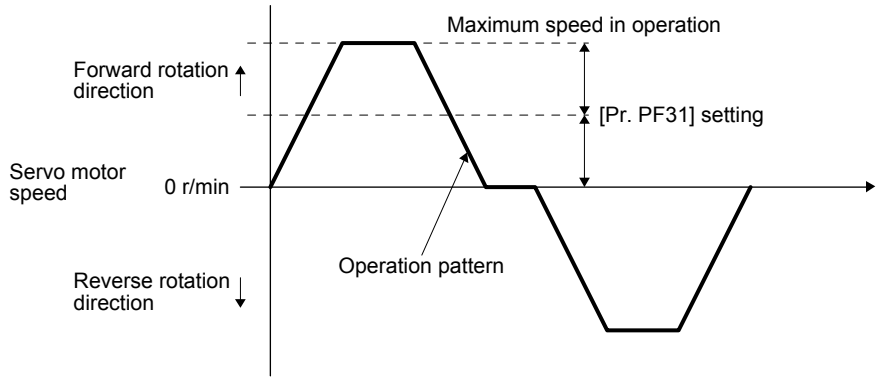
No.	Symbol	Name and function	Initial value [unit]	Setting range
PD20	*SLA1	Driver communication setting - Slave - Master axis No. selection 1 This parameter is supported with software version A2 or later. Check the software version using MR Configurator2. Select a master axis when this amplifier is slave axis. When setting this amplifier as slave axis ([Pr. PD15] is "_ _ 1 0".), set the axis No. of the servo amplifier of master. Refer to section 4.3.1 of "MR-J4-_B_(-RJ) Servo Amplifier Instruction Manual" for details of axis Nos. Setting "0" disables this parameter.	0	0 to 32
PD30	TLC	Master-slave operation - Torque command coefficient on slave This parameter is supported with software version A2 or later. Check the software version using MR Configurator2. This parameter is used to set a internal torque command coefficient to torque command value received from master axis. This parameter is enabled when this amplifier is set as slave axis ([Pr. PD15] is "_ _ 1 0".). The maximum value is 500. Setting over 500 will be 500. Setting 100 [%] means multiplication of one. The torque ratio will be 100 (master) to 100 (slave). Setting 90 [%] means multiplication of 0.9. The torque ratio will be 100 (master) to 90 (slave).	0 [%]	0 to 500
PD31	VLC	Master-slave operation - Speed limit coefficient on slave This parameter is supported with software version A2 or later. Check the software version using MR Configurator2. This parameter is used to set a internal speed limit value coefficient to speed limit command value received from master axis. This parameter is enabled when this amplifier is set as slave axis ([Pr. PD15] is "_ _ 1 0".). The maximum value is 500. Setting over 500 will be 500. Setting 100 [%] means multiplication of one. Setting example: [Pr. PD31 (VLC)] = 140 [%], [Pr. PD32 (VLL)] = 300 [r/min], and master side acceleration/deceleration at 1000 [r/min]  	0 [%]	0 to 500
PD32	VLL	Master-slave operation - Speed limit adjusted value on slave This parameter is supported with software version A2 or later. Check the software version using MR Configurator2. This parameter is used to set a minimum value for internal speed limit value. This parameter is enabled when this amplifier is set as slave axis ([Pr. PD15] is "_ _ 1 0".). The speed limit value will not be this setting value or lower. This parameter ensures torque control range at low speed driving (avoid area likely to reach speed limit). Set 100 to 500 [r/min] normally as a reference. Refer to [Pr. PD31] for the setting example.	0 [r/min]	0 to 32767

(5) Extension setting 2 parameters ([Pr. PE_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [Unit]</th><th>Setting range</th></tr>
<tr><td>PE41</td><td>EOP3</td><td>Function selection E-3
<table>
<tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr>
<tr><td>_ _ _ x</td><td>Robust filter selection
0: Disabled
1: Enabled
When you select "Enabled" of this digit, the machine resonance suppression filter 5 set in [Pr. PB51] is not available.</td><td>0h</td></tr>
<tr><td>_ _ x _</td><td>For manufacturer setting</td><td>0h</td></tr>
<tr><td>_ x _ _</td><td></td><td>0h</td></tr>
<tr><td>x _ _ _</td><td></td><td>0h</td></tr>
</table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

(6) Extension setting 3 parameters ([Pr. PF_ _])

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value [unit]</th><th>Setting range</th></tr>
<tr><td>PF06</td><td>*FOP5</td><td>Function selection F-5
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Electronic dynamic brake selection
0: Automatic (enabled only for specified servo motors)
2: Disabled
Refer to the following table for the specified servo motors.
<table><tr><th>Series</th><th>Servo motor</th></tr><tr><td>HG-KR</td><td>HG-KR053/HG-KR13/HG-KR23/HG-KR43</td></tr><tr><td>HG-MR</td><td>HG-MR053/HG-MR13/HG-MR23/HG-MR43</td></tr><tr><td>HG-SR</td><td>HG-SR51/HG-SR52</td></tr></table></td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
<tr><td>PF12</td><td>DBT</td><td>Electronic dynamic brake operating time
Set an operating time for the electronic dynamic brake.</td><td>2000
[ms]</td><td>0
to
10000</td></tr>
<tr><td>PF21</td><td>DRT</td><td>Drive recorder switching time setting
This is used to set a drive recorder switching time.
When a USB communication is cut during using a graph function, the function will be changed to the drive recorder function after the setting time of this parameter.
When a value from "1" to "32767" is set, it will switch after the setting value.
However, when "0" is set, it will switch after 600 s.
When "-1" is set, the drive recorder function is disabled.</td><td>0
[s]</td><td>-1
to
32767</td></tr>
<tr><td>PF23</td><td>OSCL1</td><td>Vibration tough drive - Oscillation detection level
This is used to set a filter readjustment sensitivity of [Pr. PB13 Machine resonance suppression filter 1] and [Pr. PB15 Machine resonance suppression filter 2] while the vibration tough drive is enabled.
Example: When you set "50" to the parameter, the filter will be readjusted at the time of 50% or more oscillation level.</td><td>50
[%]</td><td>0
to
100</td></tr>
<tr><td>PF24</td><td>*OSCL2</td><td>Vibration tough drive function selection
<table><tr><th>Setting digit</th><th>Explanation</th><th>Initial value</th></tr><tr><td>_ _ _ x</td><td>Oscillation detection alarm selection
0: [AL. 54 Oscillation detection] will occur at oscillation detection.
1: [AL. F3.1 Oscillation detection warning] will occur at oscillation detection.
2: Oscillation detection function disabled
Select alarm or warning when an oscillation continues at a filter readjustment sensitivity level of [Pr. PF23].
The digit is continuously enabled regardless of the vibration tough drive in [Pr. PA20].</td><td>0h</td></tr><tr><td>_ _ x _</td><td rowspan="3">For manufacturer setting</td><td>0h</td></tr><tr><td>_ x _ _</td><td>0h</td></tr><tr><td>x _ _ _</td><td>0h</td></tr></table></td><td colspan="2">Refer to Name and function column.</td></tr>
</table>

No.	Symbol	Name and function	Initial value [unit]	Setting range
PF25	CVAT	SEMI-F47 function - Instantaneous power failure detection time Set the time of the [AL. 10.1 Voltage drop in the control circuit power] occurrence. To disable the parameter, select "Disabled (_ 0 _ _)" of "SEMI-F47 function selection" in [Pr. PA20].	200 [ms]	30 to 200
PF31	FRIC	Machine diagnosis function - Friction judgement speed Set a servo motor speed to divide a friction estimation area into high and low for the friction estimation process of the machine diagnosis. However, setting "0" will be the value half of the rated speed. When your operation pattern is under rated speed, we recommend that you set half value to the maximum speed with this. 	0 [r/min]	0 to Permissible speed

13.3 Troubleshooting

POINT

●Refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" for details of alarms and warnings.

●As soon as an alarm occurs, make the Servo-off status and interrupt the main circuit power.

13.3.1 Alarm and warning list

When an error occurs during operation, the corresponding alarm and warning are displayed. When the alarm or the warning occurs, refer to "MELSERVO-J4 Servo Amplifier Instruction Manual (Troubleshooting)" to remove the failure. When an alarm occurs, ALM will turn off.

After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column in the following table. Warnings are automatically canceled after the cause of occurrence is removed.

For the alarms and warnings in which "SD" is written in the stop method column, the servo motor stops with the dynamic brake after forced stop deceleration. For the alarms and warnings in which "DB" or "EDB" is written in the stop method column, the servo motor stops with the dynamic brake without forced stop deceleration.

	No.	Name	Detailed display	Detail name	Stop method (Note 3, 4)	Alarm reset		
						Error reset	CPU reset	Power off to on
Alarm	10	Undervoltage	10.1	Voltage drop in the control circuit power	EDB	○	○	○
			10.2	Voltage drop in the main circuit power	SD	○	○	○
	12	Memory error 1 (RAM)	12.1	RAM error 1	DB			○
			12.2	RAM error 2	DB			○
			12.3	RAM error 3	DB			○
			12.4	RAM error 4	DB			○
			12.5	RAM error 5	DB			○
	13	Clock error	13.1	Clock error 1	DB			○
			13.2	Clock error 2	DB			○
	14	Control process error	14.1	Control process error 1	DB			○
			14.2	Control process error 2	DB			○
			14.3	Control process error 3	DB			○
			14.4	Control process error 4	DB			○
			14.5	Control process error 5	DB			○
			14.6	Control process error 6	DB			○
			14.7	Control process error 7	DB			○
			14.8	Control process error 8	DB			○
			14.9	Control process error 9	DB			○
			14.A	Control process error 10	DB			○
	15	Memory error 2 (EEP-ROM)	15.1	EEP-ROM error at power on	DB			○
			15.2	EEP-ROM error during operation	DB			○

	No.	Name	Detailed display	Detail name	Stop method (Note 3, 4)	Alarm reset		
						Error reset	CPU reset	Power off to on
Alarm	16	Encoder initial communication error 1	16.1	Encoder initial communication - Receive data error 1	DB			○
			16.2	Encoder initial communication - Receive data error 2	DB			○
			16.3	Encoder initial communication - Receive data error 3	DB			○
			16.5	Encoder initial communication - Transmission data error 1	DB			○
			16.6	Encoder initial communication - Transmission data error 2	DB			○
			16.7	Encoder initial communication - Transmission data error 3	DB			○
			16.A	Encoder initial communication - Process error 1	DB			○
			16.B	Encoder initial communication - Process error 2	DB			○
			16.C	Encoder initial communication - Process error 3	DB			○
			16.D	Encoder initial communication - Process error 4	DB			○
			16.E	Encoder initial communication - Process error 5	DB			○
			16.F	Encoder initial communication - Process error 6	DB			○
	17	Board error	17.1	Board error 1	DB			○
			17.3	Board error 2	DB			○
			17.4	Board error 3	DB			○
			17.5	Board error 4	DB			○
			17.6	Board error 5	DB			○
			17.8	Board error 6 (Note 5)	EDB			○
	19	Memory error 3 (FLASH-ROM)	19.1	FLASH-ROM error 1	DB			○
			19.2	FLASH-ROM error 2	DB			○
	1A	Servo motor combination error	1A.1	Servo motor combination error	DB			○
			1A.2	Servo motor control mode combination error	DB			○
	1E	Encoder initial communication error 2	1E.1	Encoder malfunction	DB			○
	1F	Encoder initial communication error 3	1F.1	Incompatible encoder	DB			○
	20	Encoder normal communication error 1	20.1	Encoder normal communication - Receive data error 1	EDB			○
			20.2	Encoder normal communication - Receive data error 2	EDB			○
			20.3	Encoder normal communication - Receive data error 3	EDB			○
			20.5	Encoder normal communication - Transmission data error 1	EDB			○
			20.6	Encoder normal communication - Transmission data error 2	EDB			○
			20.7	Encoder normal communication - Transmission data error 3	EDB			○
			20.9	Encoder normal communication - Receive data error 4	EDB			○
			20.A	Encoder normal communication - Receive data error 5	EDB			○
	21	Encoder normal communication error 2	21.1	Encoder data error 1	EDB			○
			21.2	Encoder data update error	EDB			○
			21.3	Encoder data waveform error	EDB			○
			21.5	Encoder hardware error 1	EDB			○
			21.6	Encoder hardware error 2	EDB			○
			21.9	Encoder data error 2	EDB			○
	24	Main circuit error	24.1	Ground fault detected by hardware detection circuit	DB			○
			24.2	Ground fault detected by software detection function	DB	○	○	○
	25	Absolute position erased	25.1	Servo motor encoder - Absolute position erased	DB			○

	No.	Name	Detailed display	Detail name	Stop method (Note 3, 4)	Alarm reset		
						Error reset	CPU reset	Power off to on
Alarm	30	Regenerative error (Note 1)	30.1	Regeneration heat error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
			30.2	Regeneration signal error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
			30.3	Regeneration feedback signal error	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	31	Overspeed	31.1	Abnormal motor speed	SD	○	○	○
	32	Overcurrent	32.1	Overcurrent detected at hardware detection circuit (during operation)	DB			○
			32.2	Overcurrent detected at software detection function (during operation)	DB	○	○	○
			32.3	Overcurrent detected at hardware detection circuit (during a stop)	DB			○
			32.4	Overcurrent detected at software detection function (during a stop)	DB	○	○	○
	33	Overvoltage	33.1	Main circuit voltage error	EDB	○	○	○
	34	SSCNET receive error 1	34.1	SSCNET receive data error	SD	○	○ (Note 2)	○
			34.2	SSCNET connector connection error	SD	○	○	○
			34.3	SSCNET communication data error	SD	○	○	○
			34.4	Hardware error signal detection	SD	○	○	○
	35	Command frequency error	35.1	Command frequency error	SD	○	○	○
	36	SSCNET receive error 2	36.1	Continuous communication data error	SD	○	○	○
	37	Parameter error	37.1	Parameter setting range error	DB		○	○
			37.2	Parameter combination error	DB		○	○
	3A	Inrush current suppression circuit error	3A.1	Inrush current suppression circuit error	EDB			○
	3D	Parameter setting error for driver communication	3D.1	Parameter combination error for driver communication on slave	DB			○
			3D.2	Parameter combination error for driver communication on master	DB			○
	3E	Operation mode error	3E.1	Operation mode error	DB			○
	45	Main circuit device overheat (Note 1)	45.1	Main circuit device overheat error	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
	46	Servo motor overheat (Note 1)	46.1	Abnormal temperature of servo motor 1	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			46.3	Thermistor disconnected	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			46.5	Abnormal temperature of servo motor 3	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
			46.6	Abnormal temperature of servo motor 4	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)

	No.	Name	Detailed display	Detail name	Stop method (Note 3, 4)	Alarm reset		
						Error reset	CPU reset	Power off to on
Alarm	47	Cooling fan error	47.1	Cooling fan stop error	SD			○
			47.2	Cooling fan speed reduction error	SD			○
	50	Overload 1 (Note 1)	50.1	Thermal overload error 1 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.2	Thermal overload error 2 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.3	Thermal overload error 4 during operation	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.4	Thermal overload error 1 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.5	Thermal overload error 2 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
			50.6	Thermal overload error 4 during a stop	SD	○ (Note 1)	○ (Note 1)	○ (Note 1)
	51	Overload 2 (Note 1)	51.1	Thermal overload error 3 during operation	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
			51.2	Thermal overload error 3 during a stop	DB	○ (Note 1)	○ (Note 1)	○ (Note 1)
	52	Error excessive	52.1	Excess droop pulse 1	SD	○	○	○
			52.3	Excess droop pulse 2	SD	○	○	○
			52.4	Error excessive during 0 torque limit	SD	○	○	○
			52.5	Excess droop pulse 3	EDB	○	○	○
	54	Oscillation detection	54.1	Oscillation detection error	EDB	○	○	○
	56	Forced stop error	56.2	Over speed during forced stop	EDB	○	○	○
			56.3	Estimated distance over during forced stop	EDB	○	○	○
	63	STO timing error	63.1	STO1 off	DB	○	○	○
			63.2	STO2 off	DB	○	○	○
	82	Master-slave operation error 1	82.1	Master-slave operation error 1	EDB	○	○	○
	8A	USB communication time-out error	8A.1	USB communication time-out error	SD	○	○	○
	8E	USB communication error	8E.1	USB communication receive error	SD	○	○	○
			8E.2	USB communication checksum error	SD	○	○	○
			8E.3	USB communication character error	SD	○	○	○
			8E.4	USB communication command error	SD	○	○	○
			8E.5	USB communication data number error	SD	○	○	○
	888	Watchdog	88._	Watchdog	DB			○

Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.

2. In some controller communication status, the alarm factor may not be removed.

3. The following shows three stop methods of DB, EDB, and SD.

- DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)
- EDB: 600 W or less servo amplifiers stops with electronic dynamic brake
  700 W or more servo amplifiers stops with dynamic brake
- SD: Forced stop deceleration

4. This is applicable when [Pr. PA04] is set to the initial value. The stop system of SD can be changed to DB using [Pr. PA04].

5. This alarm will occur only in the J3 compatibility mode.

	No.	Name	Detailed display	Detail name	Stop method (Note 2, 3)
Warning	91	Servo amplifier overheat warning (Note 1)	91.1	Main circuit device overheat warning	
	92	Battery cable disconnection warning	92.1	Encoder battery cable disconnection warning	
			92.3	Battery degradation	
	95	STO warning	95.1	STO1 off detection	DB
			95.2	STO2 off detection	DB
	96	Home position setting warning	96.1	In-position warning at home positioning	
			96.2	Command input warning at home positioning	
	9F	Battery warning	9F.1	Low battery	
	E0	Excessive regeneration warning (Note 1)	E0.1	Excessive regeneration warning	
	E1	Overload warning 1 (Note 1)	E1.1	Thermal overload warning 1 during operation	
			E1.2	Thermal overload warning 2 during operation	
			E1.3	Thermal overload warning 3 during operation	
			E1.4	Thermal overload warning 4 during operation	
			E1.5	Thermal overload error 1 during a stop	
			E1.6	Thermal overload error 2 during a stop	
			E1.7	Thermal overload error 3 during a stop	
			E1.8	Thermal overload error 4 during a stop	
	E2	Servo motor overheat warning	E2.1	Servo motor temperature warning	
	E3	Absolute position counter warning	E3.2	Encoder absolute positioning counter warning	
			E3.5	Absolute position counter warning	
	E4	Parameter warning	E4.1	Parameter setting range error warning	
	E6	Servo forced stop warning	E6.1	Forced stop warning	SD
	E7	Controller forced stop warning	E7.1	Controller forced stop warning	SD
	E8	Cooling fan speed reduction warning	E8.1	Decreased cooling fan speed warning	
			E8.2	Cooling fan stop	
	E9	Main circuit off warning	E9.1	Servo-on signal on during main circuit off	DB
			E9.2	Bus voltage drop during low speed operation	DB
			E9.3	Ready-on signal on during main circuit off	DB
	EC	Overload warning 2 (Note 1)	EC.1	Overload warning 2	
	ED	Output watt excess warning	ED.1	Output watt excess warning	
	F0	Tough drive warning	F0.1	Instantaneous power failure tough drive warning	
			F0.3	Vibration tough drive warning	
	F2	Drive recorder - Miswriting warning	F2.1	Drive recorder - Area writing time-out warning	
			F2.2	Drive recorder - Data miswriting warning	
	F3	Oscillation detection warning	F3.1	Oscillation detection warning	

Note 1. Leave for about 30 minutes of cooling time after removing the cause of occurrence.

2. The following shows two stop methods of DB and SD.
   - DB: Stops with dynamic brake. (Coasts for the servo amplifier without dynamic brake.)
   - SD: Deceleration to a stop

3. This is applicable when [Pr. PA04] is set to the initial value. The stop system of SD can be changed to DB using [Pr. PA04].

13.3.2 Troubleshooting at power on

When the servo system does not boot and system error occurs at power on of the servo system controller, improper boot of the servo amplifier might be the cause. Check the display of the servo amplifier, and take actions according to this section.

Display	Description	Cause	Checkpoint	Action
AA	Communication with the servo system controller has disconnected.	The power of the servo system controller was turned off.	Check the power of the servo system controller.	Switch on the power of the servo system controller.
		An SSCNET III cable was disconnected.	"AA" is displayed in the corresponding axis and following axes.	Replace the SSCNET III cable of the corresponding axis.
			Check if the connectors (CNIA, CNIB) are unplugged.	Connect it correctly.
		The power of the servo amplifier was turned off.	"AA" is displayed in the corresponding axis and following axes.	Check the power of the servo amplifier.
				Replace the servo amplifier of the corresponding axis.
Ab	Initialization communication with the servo system controller has not completed.	The control axis is disabled.	Check if the disabling control axis switch (SW2-2) is on.	Turn off the disabling control axis switch (SW2-2).
		The setting of the axis No. is incorrect.	Check that the other servo amplifier is not assigned to the same axis No.	Set it correctly.
		Axis No. does not match with the axis No. set to the servo system controller.	Check the setting and axis No. of the servo system controller.	Set it correctly.
		Information about the servo series has not set in the simple motion module.	Check the value set in Servo series (Pr.100) in the simple motion module.	Set it correctly.
		Communication cycle does not match.	Check the communication cycle at the servo system controller side. When using 8 axes or less: 0.222 ms When using 16 axes or less: 0.444 ms When using 32 axes or less: 0.888 ms	Set it correctly.
		An SSCNET III cable was disconnected.	"Ab" is displayed in the corresponding axis and following axes.	Replace the SSCNET III cable of the corresponding axis.
			Check if the connectors (CNIA, CNIB) are unplugged.	Connect it correctly.
		The power of the servo amplifier was turned off.	"Ab" is displayed in an axis and the following axes.	Check the power of the servo amplifier.
		The servo amplifier is malfunctioning.	"Ab" is displayed in an axis and the following axes.	Replace the servo amplifier of the corresponding axis.
b##. (Note)	The system has been in the test operation mode.	Test operation mode has been enabled.	Test operation setting switch (SW2-1) is turned on.	Turn off the test operation setting switch (SW2-1).
off	Operation mode for manufacturer setting is set.	Operation mode for manufacturer setting is enabled.	Check if all of the control axis setting switches (SW2) are on.	Set the control axis setting switches (SW2) correctly.

Note. ## indicates an axis No.

App. 1 Using the HC series/HA series servo motor

> POINT
>
> ●When using HC series and HA series servo motors, refer to "Instructions and Cautions for Drive of HC/HA Series Servo Motor with MR-J4-_B_-RJ020 Servo Amplifier" (SH(NA)030127).

When driving HC series and HA series servo motors with the MR-J4-_B_-RJ020 servo amplifier, refer to the following table for the combinations with servo amplifiers.

(1) 200 V class

Servo amplifier	Servo motor						
	HC-KFS	HC-MFS	HC-SFS	HC-RFS	HC-UFS	HA-LFS	HC-LFS
MR-J4-10B-RJ020	053 13	053 13			13		
MR-J4-20B-RJ020	23	23			23		
MR-J4-40B-RJ020	43	43			43		
MR-J4-60B-RJ020			52 53				52
MR-J4-70B-RJ020	46 410 73	73			(Note 2) 72 73		
MR-J4-100B-RJ020			81 102 103				102
MR-J4-200B-RJ020			121 201 152 202 153 203	103 153	(Note 2) 152		152
MR-J4-350B-RJ020			301 352 353	203	(Note 2) 202		202
MR-J4-500B-RJ020			502	(Note 2) 353 503	(Note 2) 352 (Note 2) 502	502	302
MR-J4-700B-RJ020			702			(Note 1) 601 (Note 1) 701M 702	
MR-J4-11KB-RJ020						(Note 1) 801 (Note 1) 11K1M 11K2 (Note 1) 12K1	
MR-J4-15KB-RJ020						(Note 1) 15K1 (Note 1) 15K1M 15K2	
MR-J4-22KB-RJ020						(Note 1) 20K1 (Note 1) 22K1M 22K2 (Note 1) 25K1	

Note 1. When you use this servo motor, please contact your local sales office.
2. Used by servo amplifiers with software version A1 or later.

(2) 400 V class

Servo amplifier	Servo motor	
	HC-SFS	HA-LFS
MR-J4-60B4-RJ020	524	
MR-J4-100B4-RJ020	1024	
MR-J4-200B4-RJ020	1524 2024	
MR-J4-350B4-RJ020	3524	
MR-J4-500B4-RJ020	5024	
MR-J4-700B4-RJ020	7024	(Note) 6014 (Note) 701M4
MR-J4-11KB4-RJ020		(Note) 8014 (Note) 11K1M4 (Note) 11K24 (Note) 12K14
MR-J4-15KB4-RJ020		(Note) 15K14 (Note) 15K1M4 (Note) 15K24
MR-J4-22KB4-RJ020		(Note) 20K14 (Note) 22K1M4 (Note) 22K24

Note. When you use this servo motor, please contact your local sales office.

(3) 100 V class

Servo amplifier	Servo motor	
	HC-KFS	HC-MFS
MR-J4-10B1-RJ020	053 13	053 13
MR-J4-20B1-RJ020	23	23
MR-J4-40B1-RJ020	43	43

App. 2 Peripheral equipment manufacturer (for reference)

Names given in the table are as of March 2014.

Manufacturer	Contact information
NEC TOKIN	NEC TOKIN Corporation
Kitagawa Industries	Kitagawa Industries Co., Ltd.
JST	J.S.T. Mfg. Co., Ltd.
Junkosha	Purchase from Toa Electric Industrial Co. Ltd., Nagoya Branch
3M	3M
SEIWA ELECTRIC	Seiwa Electric Mfg. Co. Ltd.
Soshin Electric	Soshin Electric Co., Ltd.
TE Connectivity	TE Connectivity Ltd. Company
TDK	TDK Corporation
Molex	Molex

App. 3 Handling of AC servo amplifier batteries for the United Nations Recommendations on the Transport of Dangerous Goods

United Nations Recommendations on the Transport of Dangerous Goods Rev. 15 (hereinafter Recommendations of the United Nations) has been issued. To reflect this, transport regulations for lithium metal batteries are partially revised in the Technical Instruction (ICAO-TI) by the International Civil Aviation Organization (ICAO) and the International Maritime Dangerous Goods Code (IMDG Code) by the International Maritime Organization (IMO).
To comply the instruction and code, we have modified the indication on the package for general-purpose AC servo batteries.
The above change will not affect the function and performance of the product.

(1) Target model

(a) Battery (cell)

Model	Option model
ER6	MR-J3BAT
ER17330	MR-BAT
	A6BAT

(b) Battery unit (assembled)

Model	Option model
ER17330	MR-J2M-BT
CR17335A	MR-BAT6V1
	MR-BAT6V1SET
	MR-BAT6V1BJ

(2) Purpose

Safer transportation of lithium metal batteries.

(3) Change in regulations

The following points are changed for lithium metal batteries transportation by sea or air due to Recommendations of the United Nations Rev. 15 and ICAO-TI 2009-2010 edition. For lithium metal batteries, cells are classified as UN3090, and batteries contained in or packed with equipment are classified as UN3091.

(a) A package containing 24 cells or 12 batteries or less that are not contained in equipment are no longer exempt from the following: attachment of a handling label, submission of the Shipper's Declaration for Dangerous Goods, and a 1.2 m drop test.

(b) A battery handling label (size: 120 mm × 110 mm) is required. Emergency telephone number must be filled out in the additional handling information of the Shipper's Declaration for Dangerous Goods.

(c) New handling label design containing battery illustration must be used. (only air transportation)

Figure. Example of Mitsubishi Label with Battery Illustration

(4) Action taken by Mitsubishi

The following caution will be added to the packages of the target batteries.
"Containing lithium metal battery. Regulations apply for transportation."

(5) Transportation precaution for customers

For sea or air transportation, attaching the handling label (figure) and the Shipper's Declaration for Dangerous Goods are required to the package of a Mitsubishi cell or battery. In addition, attaching them to the outer package containing several packages of Mitsubishi cells or batteries are also required. Please attach the documentations in the specified design to the packages and the outer packages.

App. 4 Symbol for the new EU Battery Directive

Symbol for the new EU Battery Directive (2006/66/EC) that is plastered to general-purpose AC servo battery is explained here.

Note. This symbol mark is for EU countries only.

This symbol mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.
Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.
This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.
If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration.
This will be indicated as follows.
Hg: Hg: mercury (0.0005%), Cd: cadmium (0.002%), Pb: lead (0.004%)
In the European Union there are separate collection systems for used batteries and accumulators. Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.
Please, help us to conserve the environment we live in!

App. 5 Compliance with global standards

POINT
●The content of the functional safety description applies to the MR-J4-_B_-RJ020 servo amplifier only when it is in the J4 mode.

App. 5.1 Terms related to safety (IEC/EN 61800-5-2 Stop function)

STO function (Refer to IEC/EN 61800-5-2: 2007 4.2.2.2 STO.)
MR-J4-_B_-RJ020 servo amplifiers have the STO function. The STO function shuts down energy to servo motors, thus removing torque. This function electronically cuts off power supply in the servo amplifier.

App. 5.2 About safety

This section explains safety of users and machine operators. Please read the section carefully before mounting the equipment.

App. 5.2.1 Professional engineer

Only professional engineers should mount MR-J4-_B_-RJ020 amplifiers.
Here, professional engineers should meet the all conditions below.

(1) Persons who took a proper engineering training or qualified persons who are engaged in electrical equipment
Check if applicable technical training is available at your local Mitsubishi Electric office. Contact your local sales office for schedules and locations.

(2) Persons who can access operating manuals for the protective devices (e.g. light curtain) connected to the safety control system. Persons who have read and familiarized himself/herself with the manuals.

App. 5.2.2 Applications of the devices

MR-J4-_B_-RJ020 servo amplifiers comply with the following safety standards.
ISO/EN ISO 13849-1 Category 3 PL d, IEC/EN 62061 SIL CL 2, IEC/EN 61800-5-2 SIL 2 (STO), IEC/EN 61800-5-1, IEC/EN 61800-3, IEC/EN 60204-1
In addition, MR-J4-_B_-RJ020 servo amplifiers can be used with the MR-D30 functional safety unit, MR-J3-D05 safety logic unit, or safety PLC.

App. 5.2.3 Correct use

Always use the MR-J4-_B_-RJ020 amplifiers within specifications (voltage, temperature, etc. Refer to section 1.3.). Mitsubishi Electric Co. accepts no claims for liability if the equipment is used in any other way or if modifications are made to the device, even in the context of mounting and installation.

⚠WARNING ●It takes 15 minutes for capacitor discharging. Do not touch the unit and terminals immediately after power off.

(1) Peripheral device and power wiring

(a) Power Wiring (local wiring and crimping tool)
Use only copper wires rated at 75 ˚C for wiring. The following table shows the wire sizes [AWG] and the crimp terminal symbols rated at 75 ˚C.

1) 200 V class servo amplifier

Table 1. Recommended wires

Servo amplifier	Wire [AWG] (Note 2)			
	L1/L2/L3 ⏚	L11/L21	P+/C	U/V/W/⏚ (Note 3)
MR-J4-10B-RJ020/MR-J4-20B-RJ020/ MR-J4-40B-RJ020/MR-J4-60B-RJ020/ MR-J4-70B-RJ020/MR-J4-100B-RJ020/ MR-J4-10B1-RJ020/MR-J4-20B1-RJ020/ MR-J4-40B1-RJ020	14	14	14	14
MR-J4-200B-RJ020	12			
MR-J4-350B-RJ020	10			12
MR-J4-500B-RJ020 (Note 1)	8: b	14: c	14: c	8: b
MR-J4-700B-RJ020 (Note 1)			12: a	
MR-J4-11KB-RJ020 (Note 1)	6: d		12: e	4: f
MR-J4-15KB-RJ020 (Note 1)	4: f		10: e	2: g
MR-J4-22KB-RJ020 (Note 1)	1/0: h		10: i	2/0: j

Note 1. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
2. Alphabets in the table indicate crimping tools. Refer to table 2 for the crimp terminals and crimping tools.
3. Select wire sizes depending on the rated output of the servo motors. The values in the table are sizes based on rated output of the servo amplifiers.

Table 2. Recommended crimp terminals

Symbol	Servo amplifier-side crimp terminals		Manufacturer
	Crimp terminal (Note 2)	Applicable tool	
a	FVD5.5-4	YNT-1210S	JST (J.S.T. Mfg. Co., Ltd.)
b (Note 1)	8-4NS	YHT-8S	
c	FVD2-4	YNT-1614	
d	FVD14-6	YF-1	
e	FVD5.5-6	YNT-1210S	
f	FVD22-6	YF-1	
g	FVD38-6	YF-1	
h	R60-8	YF-1	
i	FVD5.5-8	YNT-1210S	
j	CB70-S8	YF-1	

Note 1. Coat the crimped part with an insulation tube.
2. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended terminals or equivalent.

2) 400 V class servo amplifier

Table 3. Recommended wires

Servo amplifier	Wire [AWG] (Note 2)			
	L1/L2/L3 ⏚	L11/L21	P+/C	U/V/W/⏚ (Note 3)
MR-J4-60B4-RJ020/MR-J4-100B4-RJ020	14	14	14	14
MR-J4-200B4-RJ020				
MR-J4-350B4-RJ020				
MR-J4-500B4-RJ020 (Note1)	14: b	14: b	14: b	12: a
MR-J4-700B4-RJ020 (Note 1)	12: a			10: a
MR-J4-11KB4-RJ020 (Note1)	10: d		14: e	8: f
MR-J4-15KB4-RJ020 (Note1)	8: f		12: d	6: c
MR-J4-22KB4-RJ020 (Note1)	6: g		12: h	4: i

Note 1. To connect these models to a terminal block, be sure to use the screws that come with the terminal block.
2. Alphabets in the table indicate crimping tools. Refer to table 4 for the crimp terminals and crimping tools.
3. Select wire sizes depending on the rated output of the servo motors. The values in the table are sizes based on rated output of the servo amplifiers.

Table 4. Recommended crimp terminals

Symbol	Servo amplifier-side crimp terminals		Manufacturer
	Crimp terminal (Note)	Applicable tool	
a	FVD5.5-4	YNT-1210S	JST (J.S.T. Mfg. Co., Ltd.)
b	FVD2-4	YNT-1614	
c	FVD14-6	YF-1	
d	FVD5.5-6	YNT-1210S	
e	FVD2-6	YNT-1614	
f	FVD8-6	YF-1	
g	FVD14-8	YF-1	
h	FVD5.5-8	YNT-1210S	
i	FVD22-8	YF-1	

Note. Some crimp terminals may not be mounted depending on their sizes. Make sure to use the recommended terminals or equivalent.

(b) Selection example of MCCB and fuse

Use T class fuses or molded-case circuit breaker (UL489 Listed MCCB) as the following table. The T class fuses and molded-case circuit breakers in the table are selected examples based on rated I/O of the servo amplifiers. When you select a smaller capacity servo motor to connect it to the servo amplifier, you can also use smaller capacity T class fuses or molded-case circuit breaker than ones in the table. For selecting ones other than Class T fuses and molded-case circuit breakers below, refer to section 11.10.

1) 200 V class servo amplifier

Servo amplifier (Note)	Molded-case circuit breaker (240 V AC)	Fuse (300 V)
MR-J4-10B-RJ020/MR-J4-20B-RJ020/MR-J4-40B-RJ020/ MR-J4-60B-RJ020(T)/MR-J4-70B-RJ020(T)	NF50-SVFU-5A (50 A frame 5 A)	10 A
MR-J4-60B-RJ020(S)/MR-J4-70B-RJ020(S)/ MR-J4-100B-RJ020	NF50-SVFU-10A (50 A frame 10 A)	15 A
MR-J4-200B-RJ020	NF50-SVFU-15A (50 A frame 15 A)	30 A
MR-J4-350B-RJ020	NF50-SVFU-20A (50 A frame 20 A)	40 A
MR-J4-500B-RJ020	NF50-SVFU-30A (50 A frame 30 A)	60 A
MR-J4-700B-RJ020	NF50-SVFU-40A (50 A frame 40 A)	80 A
MR-J4-11KB-RJ020	NF100-CVFU-60A (100 A frame 60 A)	125 A
MR-J4-15KB-RJ020	NF100-CVFU-80A (100 A frame 80 A)	150 A
MR-J4-22KB-RJ020	NF225-CWU-125A (225 A frame 125 A)	300 A

Note. "(S)" means 1-phase 200 V AC power input and "(T)" means 3-phase 200 V AC power input in the table.

2) 400 V class servo amplifier

Servo amplifier	Molded-case circuit breaker (480 V AC)	Fuse (600 V)
MR-J4-60B4-RJ020	NF100-HRU-5A (100 A frame 5 A)	10 A
MR-J4-100B4-RJ020	NF100-HRU-5A (100 A frame 5 A)	10 A
MR-J4-200B4-RJ020	NF100-HRU-10A (100 A frame 10 A)	15 A
MR-J4-350B4-RJ020	NF100-HRU-10A (100 A frame 10 A)	20 A
MR-J4-500B4-RJ020	NF100-HRU-15A (100 A frame 15 A)	30 A
MR-J4-700B4-RJ020	NF100-HRU-20A (100 A frame 20 A)	40 A
MR-J4-11KB4-RJ020	NF100-HRU-30A (100 A frame 30 A)	60 A
MR-J4-15KB4-RJ020	NF100-HRU-40A (100 A frame 40 A)	80 A
MR-J4-22KB4-RJ020	NF100-HRU-60A (100 A frame 60 A)	125 A

3) 100 V class servo amplifier

Servo amplifier	Molded-case circuit breaker (120 V AC)	Fuse (300 V)
MR-J4-10B1-RJ020 MR-J4-20B1-RJ020 MR-J4-40B1-RJ020	NV50-SVFU-15A (50 A frame 15 A)	20 A

(c) Power supply

This servo amplifier can be supplied from star-connected supply with grounded neutral point of overvoltage category III set forth in IEC/EN 60664-1. However, when you use the neutral point for single phase supply, a reinforced insulating transformer is required in the power input section. For the interface power supply, use an external 24 V DC power supply with reinforced insulation on I/O terminals.

(d) Grounding

To prevent an electric shock, always connect the protective earth (PE) terminal (marked ⏚) of the servo amplifier to the protective earth (PE) of the cabinet. Do not connect two grounding cables to the same protective earth (PE) terminal. Always connect cables to the terminals one-to-one.

If using an earth-leakage current breaker, always ground the protective earth (PE) terminal of the servo amplifier to prevent an electric shock. This product can cause a d.c. current in the protective earthing conductor. Where a residual current-operated protective (RCD: earth-leakage current breaker) device is used for protection in case of direct or indirect contact, only an RCD of Type B is allowed on the supply side of this product.

The MR-J4-700_4-RJ020 is high protective earthing conductor current equipment, the minimum size of the protective earthing conductor must comply with the local safety regulations.

(2) EU compliance

The MR-J4-_B_-RJ020 servo amplifiers are designed to comply with the following directions to meet requirements for mounting, using, and periodic technical inspections: Machinery directive (2006/42/EC), EMC directive (2004/108/EC), and Low-voltage directive (2006/95/EC).

(a) EMC requirement

MR-J4-_B_-RJ020 servo amplifiers comply with category C3 in accordance with EN 61800-3. As for I/O wires (max. length 10 m. However, 3 m for the STO cable for CN8.) and encoder cables (max. length 50 m), use shielded wires and ground the shields. Use an EMC filter and surge protector on the primary side for input of 200 V class and for input and output of 400 V class servo amplifiers. In addition, use a line noise filter for outputs of the 11 kW and 15 kW of 400 V class servo amplifiers. The following shows recommended products.

EMC filter: Soshin Electric HF3000A-UN series

Surge protector: Okaya Electric Industries RSPD-250-U4 series

Line noise filter: Mitsubishi Electric FR-BLF

- MR-J4 Series are not intended to be used on a low-voltage public network which supplies domestic premises;
- radio frequency interference is expected if used on such a network.
  The installer shall provide a guide for Installation and use, including recommended mitigation devices.

(b) For Declaration of Conformity (DoC)

Hereby, MITSUBISHI ELECTRIC EUROPE B.V., declares that the servo amplifiers are in compliance with the necessary requirements and standards (2006/42/EC, 2004/108/EC and 2006/95/EC). For the copy of Declaration of Conformity, contact your local sales office.

(3) USA/Canada compliance

This servo amplifier is designed in compliance with UL 508C and CSA C22.2 No.14.

(a) Installation

The minimum cabinet size is 150% of the MR-J4-_B_-RJ020 servo amplifier's volume. Also, design the cabinet so that the ambient temperature in the cabinet is 55 ˚C or less. The servo amplifier must be installed in a metal cabinet. For environment, the units should be used in open type (UL 50) and overvoltage category III or lower. The servo amplifier needs to be installed at or below of pollution degree 2. For connection, use only copper wires.

(b) Short-circuit current rating (SCCR)

Suitable For Use On A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum.

(c) Overload protection characteristics

The MR-J4-_B_-RJ020 servo amplifiers have servo motor overload protective function. (It is set on the basis (full load current) of 115% rated current of the servo amplifier.)

(d) Over-temperature protection for motor

Motor Over temperature sensing is not provided by the drive.
Integral thermal protection(s) is necessary for motor and refer to app. 5.4 for the proper connection.

(e) Branch circuit protection

For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.
For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes.

(4) South Korea compliance

This product complies with the Radio Wave Law (KC mark). Please note the following to use the product.

이 기기는 업무용 (A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라며 ,
가정외의 지역에서 사용하는 것을 목적으 로 합니다.

(The product is for business use (Class A) and meets the electromagnetic compatibility requirements. The seller and the user must note the above point, and use the product in a place except for home. In addition, use an EMC filter, surge protector, ferrite core, and line noise filter on the primary side for inputs. Use a ferrite core and line noise filter for outputs. Use a distance greater than 30 m between the product and third party sensitive radio communications for an MR-J4-22K_(4).)

App. 5.2.4 General cautions for safety protection and protective measures

Observe the following items to ensure proper use of the MR-J4-_B_-RJ020 servo amplifiers.

(1) For safety components and installing systems, only qualified personnel and professional engineers should perform.

(2) When mounting, installing, and using the MR-J4-_B_-RJ020 servo amplifier, always observe standards and directives applicable in the country.

(3) The item about noises of the test notices in the manuals should be observed.

App. 5.2.5 Residual risk

(1) Be sure that all safety related switches, relays, sensors, etc., meet the required safety standards.

(2) Perform all risk assessments and safety level certification to the machine or the system as a whole.

(3) If the upper and lower power modules in the servo amplifier are shorted and damaged simultaneously, the servo motor may make a half revolution at a maximum.

(4) Only qualified personnel are authorized to install, start-up, repair or service the machines in which these components are installed. Only trained engineers should install and operate the equipment. (ISO 13849-1 Table F.1 No.5)

(5) Separate the wiring for functional safety observation from other signal wirings. (ISO 13849-1 Table F.1 No.1)

(6) Protect the cables with appropriate ways (routing them in a cabinet, using a cable guard, etc.).

(7) Keep the required clearance/creepage distance depending on voltage you use.

App. 5.2.6 Disposal

Disposal of unusable or irreparable devices should always occur in accordance with the applicable country-specific waste disposal regulations. (Example: European Waste 16 02 14)

App. 5.2.7 Lithium battery transportation

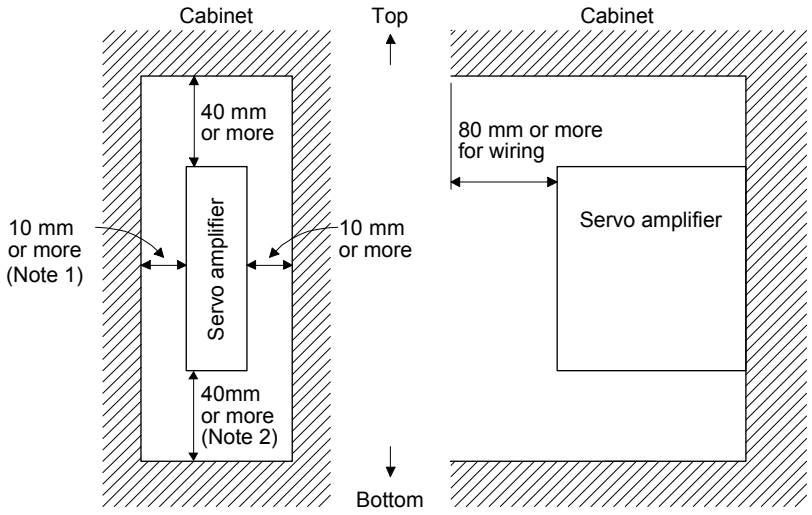
To transport lithium batteries, take actions to comply with the instructions and regulations such as the United Nations (UN), the International Civil Aviation Organization (ICAO), and the International Maritime Organization (IMO).
The battery options (MR-BAT6V1SET and MR-BAT6V1) are assembled batteries from lithium metal battery CR17335A which are not subject to the dangerous goods (Class 9) of the UN Recommendations.

App. 5.3 Mounting/dismounting

Installation direction and clearances

⚠CAUTION

- The devices must be installed in the specified direction. Not doing so may cause a malfunction.
- Mount the servo amplifier on a cabinet which meets IP54 in the correct vertical direction to maintain pollution degree 2.
- Note the followings for supplied regenerative resistors of 11 kW to 22 kW servo amplifiers because they do not have protect covers.
  - Touching the resistor will cause a burn because the surface of the parts is a resistive element and very high temperature.
  - Even if the power turned off, touching the resistor will cause an electric shock because the capacitor of the servo amplifier is charged for a while.



Note 1. For the MR-J4-500B-RJ020, the clearance between the left side and wall will be 25 mm or more.

2. For 11 kW to 22 kW servo amplifiers, the clearance between the bottom and ground will be 120 mm or more.

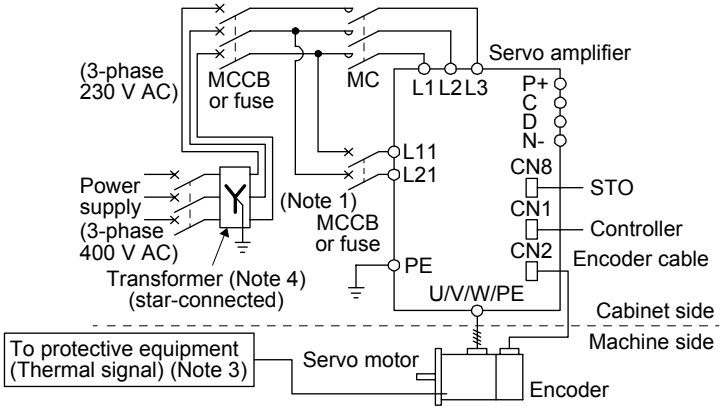
App. 5.4 Electrical Installation and configuration diagram

⚠WARNING ●Turn off the molded-case circuit breaker (MCCB) to avoid electrical shocks or damages to the product before starting the installation or wiring.

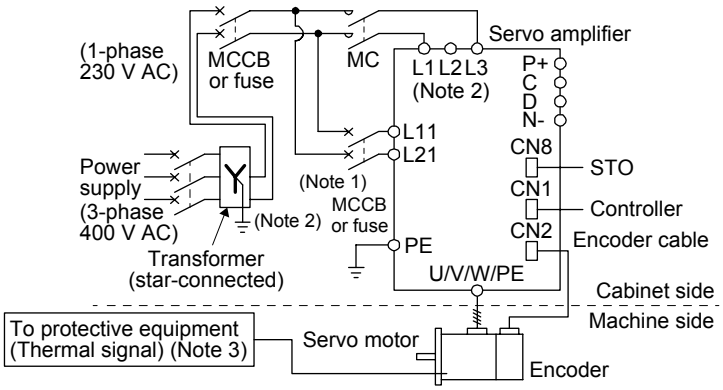
⚠CAUTION
- ●The installation complies with IEC/EN 60204-1. The voltage supply to machines must be 20 ms of tolerance against instantaneous power failures as specified in IEC/EN 60204-1.
- ●Connecting a servo motor of the wrong axis to U, V, W, or CN2 of the servo amplifier may cause a malfunction.

The following shows representative configuration examples to conform to the IEC/EN/UL/CSA standards.

(a) 3-phase input



(b) 1-phase input



Note 1. When the wire sizes of L1 and L11 are the same, MCCB or fuse is not required.
2. When using a 100 V class servo amplifier, step down the power supply voltage to 100 V and connect the main circuit power supply lines to L1 and L2. For 1-phase 200 V AC servo amplifiers, connect the lines to L1 and L3.
3. Please use a thermal sensor, etc. for thermal protection of the servo motor.
4. For 400 V class, a step-down transformer is not required.

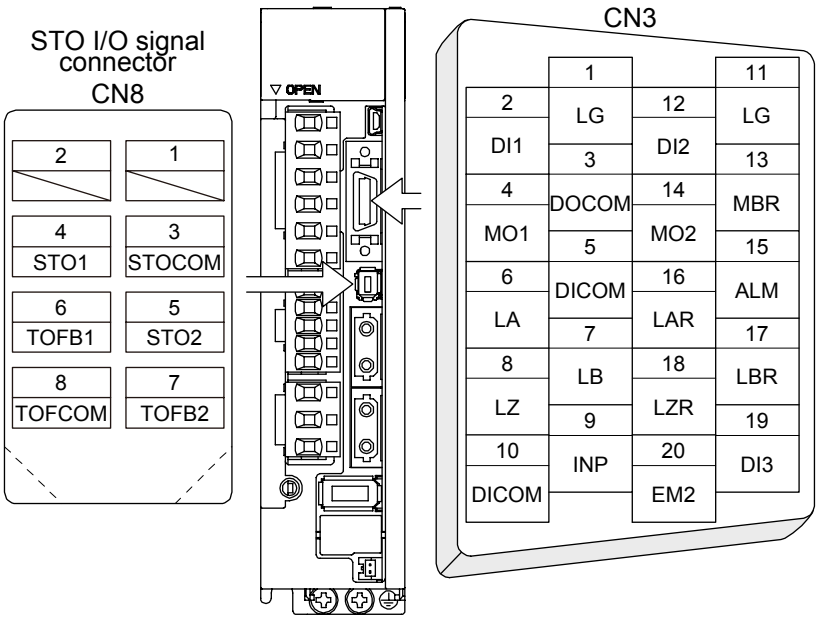
The control circuit connectors described by rectangles are safely separated from the main circuits described by circles.
The connected motors will be limited as follows.

(1) HG series servo motors (Mfg.: Mitsubishi Electric)
(2) Using a servo motor complied with IEC60034-1 and Mitsubishi Electric encoder (OBA, OSA)

App. 5.5 Signal

App. 5.5.1 Signal

The following shows MR-J4-10B-RJ020 signals as a typical example. Refer to section 3.4 for other connectors.



App. 5.5.2 Input device

Input device

Symbol	Device	Connector	Pin No.
EM2	Forced stop 2	CN3	20
STOCOM	Common terminal for input signals STO1/STO2	CN8	3
STO1	STO1 state input		4
STO2	STO2 state input		5

Output device

Symbol	Device	Connector	Pin No.
TOFCOM	Common terminal for monitor output signal in STO state	CN8	8
TOFB1	Monitor output signal in STO1 state		6
TOFB2	Monitor output signal in STO2 state		7

Power

Symbol	Device	Connector	Pin No.
DICOM	Digital I/F power supply input	CN3	5, 10
DOCOM	Digital I/F common		3
SD	Shield		Plate

App. 5.6 Maintenance and service

> ⚠WARNING ●To avoid an electric shock, only qualified personnel should attempt inspections. For repair and parts replacement, contact your local sales office.

App. 5.6.1 Inspection items

It is recommended that the following points periodically be checked.

(1) Check for loose terminal block screws. Retighten any loose screws.

1) 200 V/100 V class

Servo amplifier	Tightening torque [N•m]														
	L1	L2	L3	N-	P3	P4	P+	C	D	L11	L21	U	V	W	PE
MR-J4-10B-RJ020 MR-J4-20B-RJ020 MR-J4-40B-RJ020 MR-J4-60B-RJ020 MR-J4-70B-RJ020 MR-J4-100B-RJ020 MR-J4-200B-RJ020 MR-J4-350B-RJ020 MR-J4-10B1-RJ020 MR-J4-20B1-RJ020 MR-J4-40B1-RJ020															1.2
MR-J4-500B-RJ020	1.2									0.8		1.2			
MR-J4-700B-RJ020	1.2									0.8		1.2			
MR-J4-11KB-RJ020 MR-J4-15KB-RJ020	3.0									1.2		3.0			
MR-J4-22KB-RJ020	6.0									1.2		6.0			

2) 400 V class

Servo amplifier	Tightening torque [N•m]													
	L1	L2	L3	N-	P3	P4	P+	C	L11	L21	U	V	W	PE
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020 MR-J4-200B4-RJ020 MR-J4-350B4-RJ020														1.2
MR-J4-500B4-RJ020	1.2								0.8		1.2			
MR-J4-700B4-RJ020	1.2								0.8		1.2			
MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020	3.0								1.2		3.0			
MR-J4-22KB4-RJ020	6.0								1.2		6.0			

(2) Check servo motor bearings, brake section, etc. for unusual noise.

(3) Check the cables and the like for scratches or cracks. Perform periodic inspection according to operating conditions.

(4) Check that the connectors are securely connected to the servo motor.

(5) Check that the wires are not coming out from the connector.

(6) Check for dust accumulation on the servo amplifier and MR-J4-T20.

(7) Check for unusual noise generated from the servo amplifier and MR-J4-T20.

(8) Check the servo motor shaft and coupling for connection.

App. 5.6.2 Parts having service lives

Service lives of the following parts are listed below. However, the service life vary depending or operating methods and environment. If any fault is found in the parts, they must be replaced immediately regardless of their service lives. For parts replacement, please contact your local sales office.

Part name	Life guideline
Smoothing capacitor	(Note 3) 10 years
Relay	Number of power-on, forced stop, and controller forced stop times: 100000 times Number of on and off for STO: 1,000,000 times
Cooling fan	10,000 hours to 30,000 hours (2 years to 3 years)
(Note 1) Battery backup time	Approximately 20,000 hours (equipment power supply: off, ambient temperature: 20 °C)
(Note 2) Battery life	Five years from date of manufacture

Note 1. The time is for using MR-J4 1-axis servo amplifier with an rotary servo motor using MR-BAT6V1SET.
2. Quality of the batteries degrades by the storage condition. The battery life is five years from the production date regardless of the connection status.
3. The characteristic of smoothing capacitor is deteriorated due to ripple currents, etc. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment (40 ˚C surrounding air temperature or less).

App. 5.7 Transportation and storage

⚠CAUTION
- ●Transport the products correctly according to their mass.
- ●Stacking in excess of the limited number of product packages is not allowed.
- ●Do not hold the front cover to transport the servo amplifier. Otherwise, it may drop.
- ●Install the servo amplifier and servo motor in a load-bearing place in accordance with the Instruction Manual.
- ●Do not get on or put heavy load on the equipment.
- ●For detailed information on the option battery's transportation and handing, refer to appendix 3 and 4.

When you keep or use it, please fulfill the following environment.

Item		Environment
Ambient temperature	Operation [°C]	0 to 55 Class 3K3 (IEC/EN 60721-3-3)
	Transportation (Note) [°C]	-20 to 65 Class 2K4 (IEC/EN 60721-3-2)
	Storage (Note) [°C]	-20 to 65 Class 1K4 (IEC/EN 60721-3-1)
Ambient humidity	Operation, transportation, storage	5 %RH to 90 %RH
Vibration resistance	Test condition	10 Hz to 57 Hz with constant amplitude of 0.075 mm 57 Hz to 150 Hz with constant acceleration of 9.8 m/s^2 to IEC/EN 61800-5-1 (Test Fc of IEC 60068-2-6)
	Operation	5.9 m/s^2
	Transportation (Note)	Class 2M3 (IEC/EN 60721-3-2)
	Storage	Class 1M2 (IEC/EN 60721-3-2)
Pollution degree		2
IP rating		IP20 (IEC/EN 60529) Except terminal block and fan finger guard
		Open type (UL 50)
Altitude	Operation, storage	1000 m or less above sea level
	Transportation	10000 m or less above sea level

Note. In regular transport packaging

App. 5.8 Technical data

App. 5.8.1 MR-J4 servo amplifier

1) 200 V/100 V class servo amplifier

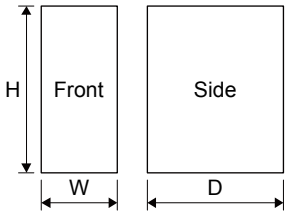
Item		MR-J4-10B-RJ020/ MR-J4-20B-RJ020/ MR-J4-40B-RJ020/ MR-J4-60B-RJ020/ MR-J4-70B-RJ020	MR-J4-100B-RJ020/ MR-J4-200B-RJ020/ MR-J4-350B-RJ020/ MR-J4-500B-RJ020/ MR-J4-700B-RJ020/ MR-J4-11KB-RJ020/ MR-J4-15KB-RJ020/ MR-J4-22KB-RJ020	MR-J4-10B1-RJ020/ MR-J4-20B1-RJ020/ MR-J4-40B1-RJ020
Power supply	Main circuit (line voltage)	3-phase or 1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz	3-phase 200 V AC to 240 V AC, 50 Hz/60 Hz	1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz
	Control circuit (line voltage)	1-phase 200 V AC to 240 V AC, 50 Hz/60 Hz		1-phase 100 V AC to 120 V AC, 50 Hz/60 Hz
	Interface (SELV)	24 V DC, (required current capacity: 200 mA)		
Control method		Sine-wave PWM control, current control method		
Pollution degree		2 (IEC/EN 60664-1)		
Overvoltage category		1-phase 100 V AC/200 V AC: II (IEC/EN 60664-1), 3-phase 200 V AC/400 V AC: III (IEC/EN 60664-1)		
Protection class		I (IEC/EN 61800-5-1)		
Short-circuit current rating (SCCR)		100 kA		

2) 400 V class servo amplifier

Item		MR-J4-60B4-RJ020/MR-J4-100B4-RJ020/MR-J4-200B4-RJ020/ MR-J4-350B4-RJ020/MR-J4-500B4-RJ020/MR-J4-700B4-RJ020/ MR-J4-11KB4-RJ020/MR-J4-15KB4-RJ020/MR-J4-22KB4-RJ020
Power supply	Main circuit (line voltage)	3-phase 380 V AC to 480 V AC, 50 Hz/60 Hz
	Control circuit (line voltage)	1-phase 380 V AC to 480 V AC, 50 Hz/60 Hz
	Interface (SELV)	24 V DC, (required current capacity: 200 mA)
Control method		Sine-wave PWM control, current control method
Pollution degree		2 (IEC/EN 60664-1)
Overvoltage category		III (IEC/EN 60664-1)
Protection class		I (IEC/EN 61800-5-1)
Short-circuit current rating (SCCR)		100 kA

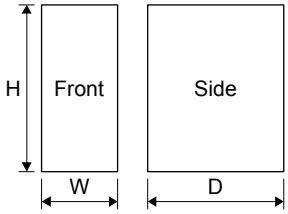
App. 5.8.2 Servo amplifier dimensions

(1) 200 V/100 V class servo amplifier



Servo amplifier	Variable dimension table [mm]			Mass [kg]
	W	H	D	
MR-J4-10B-RJ020 MR-J4-20B-RJ020 MR-J4-10B1-RJ020 MR-J4-20B1-RJ020	40	168	135	0.8
MR-J4-40B-RJ020 MR-J4-60B-RJ020 MR-J4-40B1-RJ020	40	168	170	1.0
MR-J4-70B-RJ020 MR-J4-100B-RJ020	60	168	185	1.4
MR-J4-200B-RJ020	90	168	195	2.1
MR-J4-350B-RJ020	90	168	195	2.3
MR-J4-500B-RJ020	105	250	200	4.6
MR-J4-700B-RJ020	172	300	200	6.2
MR-J4-11KB-RJ020 MR-J4-15KB-RJ020	220	400	260	13.4
MR-J4-22KB-RJ020	260	400	260	18.2

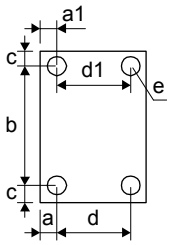
(2) 400 V class servo amplifier



Servo amplifier	Variable dimension table [mm]			Mass [kg]
	W	H	D	
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020	60	168	195	1.7
MR-J4-200B4-RJ020	90	168	195	2.1
MR-J4-350B4-RJ020	105	250	200	3.6
MR-J4-500B4-RJ020	130	250	200	4.3
MR-J4-700B4-RJ020	172	300	200	6.5
MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020	220	400	260	13.4
MR-J4-22KB4-RJ020	260	400	260	18.2

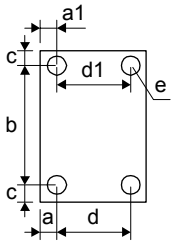
App. 5.8.3 Mounting hole

(1) 200 V/100 V class servo amplifier



Servo amplifier	Variable dimensions [mm]						Screw size
	a	a1	b	c	d	d1	e
MR-J4-10B-RJ020 MR-J4-20B-RJ020 MR-J4-40B-RJ020 MR-J4-60B-RJ020 MR-J4-10B1-RJ020 MR-J4-20B1-RJ020 MR-J4-40B1-RJ020	6	6	156 ± 0.5	6			M5
MR-J4-70B-RJ020 MR-J4-100B-RJ020	12	12	156 ± 0.5	6	42 ± 0.3		M5
MR-J4-200B-RJ020 MR-J4-350B-RJ020	6	45	156 ± 0.5	6	78 ± 0.3		M5
MR-J4-500B-RJ020	6	6	235 ± 0.5	7.5	93 ± 0.5	93 ± 0.5	M5
MR-J4-700B-RJ020	6	6	285 ± 0.5	7.5	160 ± 0.5	160 ± 0.5	M5
MR-J4-11KB-RJ020 MR-J4-15KB-RJ020	12	12	380 ± 0.5	10	196 ± 0.5	196 ± 0.5	M5
MR-J4-22KB-RJ020	12	12	376 ± 0.5	12	236 ± 0.5	236 ± 0.5	M10

(2) 400 V class servo amplifier



Servo amplifier	Variable dimensions [mm]						Screw size
	a	a1	b	c	d	d1	e
MR-J4-60B4-RJ020 MR-J4-100B4-RJ020	12	12	156 ± 0.5	6	42 ± 0.3		M5
MR-J4-200B4-RJ020	6	45	156 ± 0.5	6	78 ± 0.3		M5
MR-J4-350B4-RJ020	6	6	235 ± 0.5	7.5	93 ± 0.3	93 ± 0.3	M5
MR-J4-500B4-RJ020	6	6	235 ± 0.5	7.5	118 ± 0.5	118 ± 0.5	M5
MR-J4-700B4-RJ020	6	6	285 ± 0.5	7.5	160 ± 0.5	160 ± 0.5	M5
MR-J4-11KB4-RJ020 MR-J4-15KB4-RJ020	12	12	380 ± 0.5	10	196 ± 0.5	196 ± 0.5	M5
MR-J4-22KB4-RJ020	12	12	376 ± 0.5	12	236 ± 0.5	236 ± 0.5	M10

App. 5.9 Check list for user documentation

MITSUBISHI ELECTRIC

MR-J4 installation checklist for manufacturer/installer

The following items must be satisfied by the initial test operation at least. The manufacturer/installer must be responsible for checking the standards in the items.
Maintain and keep this checklist with related documents of machines to use this for periodic inspection.

1. Is it based on directive/standard applied to the machine? Yes [ ], No [ ]
2. Is directive/standard contained in Declaration of Conformity (DoC)? Yes [ ], No [ ]
3. Does the protection instrument conform to the category required? Yes [ ], No [ ]
4. Are electric shock protective measures (protection class) effective? Yes [ ], No [ ]
5. Is the STO function checked (test of all the shut-off wiring)? Yes [ ], No [ ]

Checking the items will not be instead of the first test operation or periodic inspection by professional engineers.

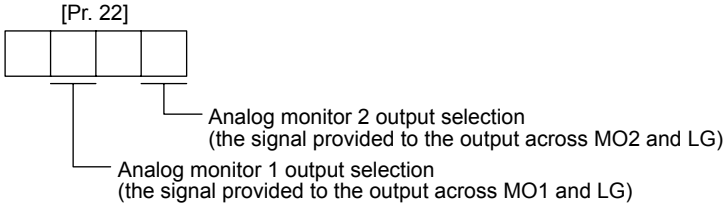
App. 6 Analog monitor

POINT
●A voltage of analog monitor output may be irregular at power-on. ●Appendix 6 explains when the MR-J4-_B_-RJ020 servo amplifier is in the J2S compatibility mode.

The servo status can be outputted to two channels in terms of voltage.

(1) Setting

Change the following digits of [Pr. 22].


[Pr. 22]
Analog monitor 2 output selection
(the signal provided to the output across MO2 and LG)
Analog monitor 1 output selection
(the signal provided to the output across MO1 and LG)

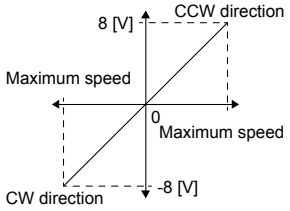
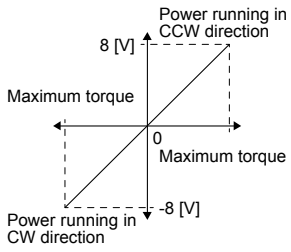
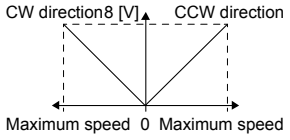
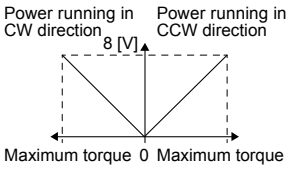
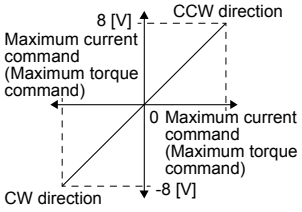
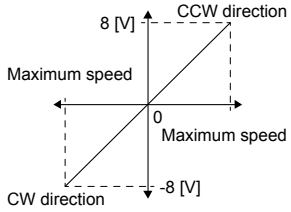
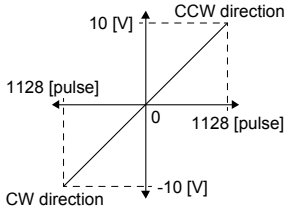
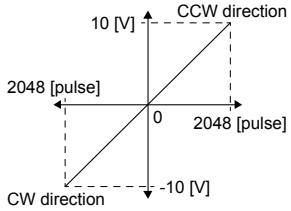
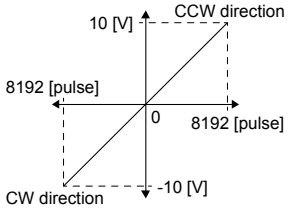
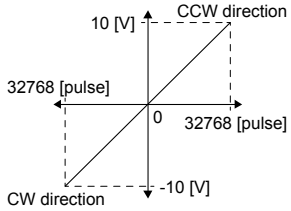
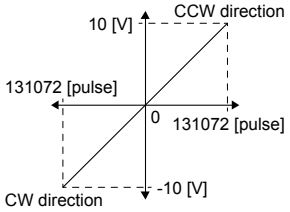
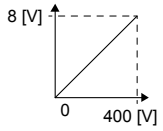
[Pr. 27] and [Pr. 28] can be used to set the offset voltages to the analog output voltages. Setting value is -999 mV to 999 mV.

Parameter	Description	Setting range [mV]
27	This is used to set the offset voltage of MO1 (Analog monitor 1).	-999 to 999
28	This is used to set the offset voltage of MO2 (Analog monitor 2).	

(2) Setting

The servo amplifier is factory-set to output the servo motor speed to MO1 (Analog monitor 1) and the torque to MO2 (Analog monitor 2). The setting can be changed as listed below by setting the [Pr. 22] value.

Refer to (3) for the detection point.

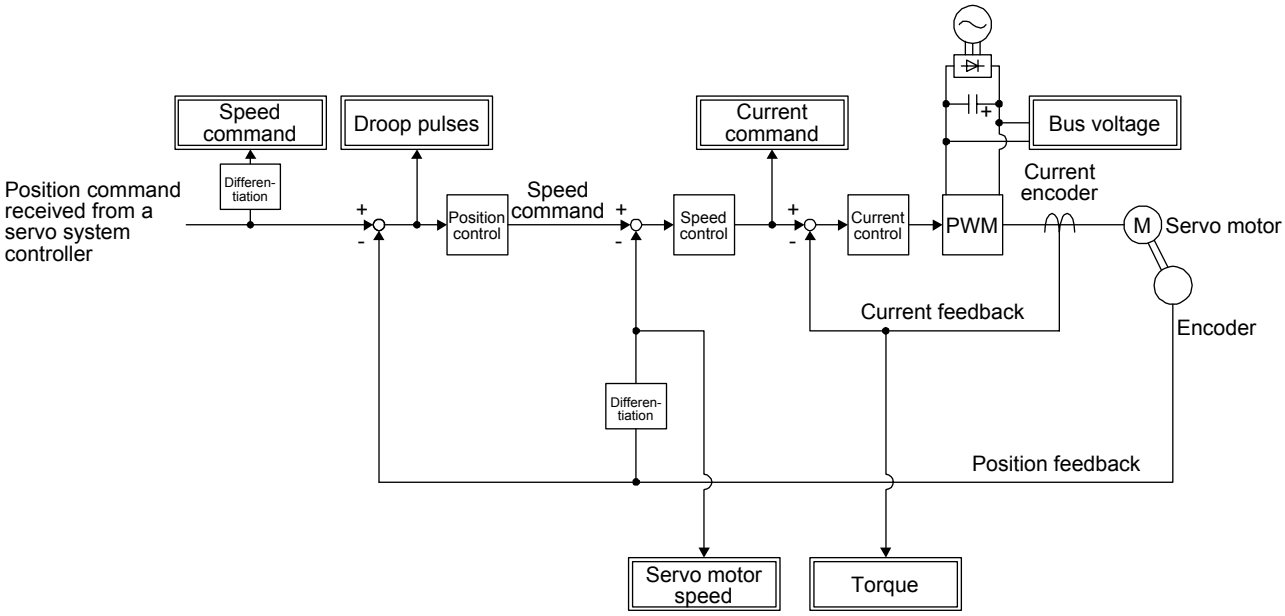
Setting value	Output item	Description	Setting value	Output item	Description
0	Servo motor speed		1	Torque (Note 1)	
2	Servo motor speed		3	Torque (Note 1)	
4	Current command		5	Speed command	
6	Droop pulses (Note 2) (±10 V/1128 pulses)		7	Droop pulses (Note 2) (±10 V/2048 pulses)	
8	Droop pulses (Note 2) (±10 V/8192 pulses)		9	Droop pulses (Note 2) (±10 V/32768 pulses)	
A	Droop pulses (Note 2) (±10 V/131072 pulses)		B	Bus voltage (Note 3)	

Note 1. 8 V is outputted at the maximum torque.

2. Encoder pulse unit

3. For 400 V class servo amplifier, the bus voltage becomes +8 V/800 V.

(3) Analog monitor block diagram



App. 7 Special specification

App. 7.1 Amplifier without dynamic brake

App. 7.1.1 Summary

This section explains servo amplifiers without dynamic brakes. Items not given in this section will be the same as MR-J4-_B_-RJ020.

App. 7.1.2 Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.

MR－J 4－6 0 B 4－R U 0 2 0

Series

Special specifications

Symbol	Special specifications
RU020	MR-J4-_B_-RJ020 without a dynamic brake

Power supply

Symbol	Power supply
None	3-phase 200 V AC to 240 V AC
1	1-phase 100 V AC to 120 V AC
4	3-phase 380 V AC to 480 V AC

Rated output

Symbol	Rated output [kW]
10	0.1
20	0.2
40	0.4
60	0.6
70	0.75
100	1
200	2
350	3.5
500	5
700	7

App. 7.1.3 Specifications

The dynamic brake built-in the 7 kW or lower servo amplifier is removed.
Take safety measures such as making another circuit in case of an emergency stop, alarm, and servo motor stop at power supply shut-off.
When the following servo motors are used, the electronic dynamic brake can start at an alarm occurrence.

Series	Servo motor
HG-KR	HG-KR053/HG-KR13/HG-KR23/HG-KR43
HG-MR	HG-MR053/HG-MR13/HG-MR23/HG-MR43
HG-SR	HG-SR51/HG-SR52

Setting the following parameter disables the electronic dynamic brake.

(1) At J2S compatibility mode

Servo amplifier	Parameter	Setting value
MR-J4-_B_-RU020	[Pr. 56]	2 _ _ _

(2) At J4 mode

Servo amplifier	Parameter	Setting value
MR-J4-_B_-RU020	[Pr. PF06]	_ _ _ 2

Additionally, when [Pr. PA04] is "2 _ _ _" (initial value) for an MR-J4-_B_-RU020 in J4 mode, an alarm may trigger the forced stop deceleration. Setting "0 _ _ _" in [Pr. PA04] disables the forced stop deceleration.

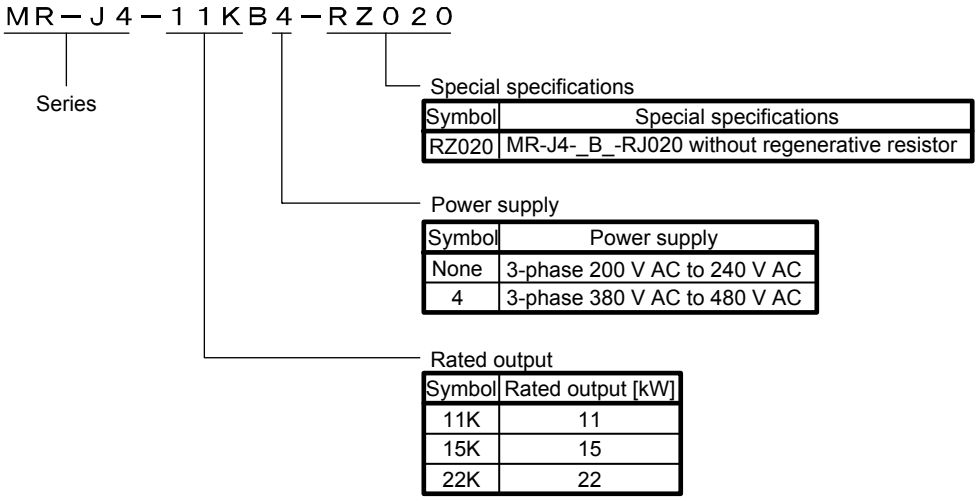
App. 7.2 Without regenerative resistor

App. 7.2.1 Summary

This section explains servo amplifiers without regenerative resistors. Items not given in this section will be the same as MR-J4-_B_-RJ020.

App. 7.2.2 Model

The following describes what each block of a model name indicates. Not all combinations of the symbols are available.



Special specifications	
Symbol	Special specifications
RZ020	MR-J4-_B_-RJ020 without regenerative resistor

Power supply	
Symbol	Power supply
None	3-phase 200 V AC to 240 V AC
4	3-phase 380 V AC to 480 V AC

Rated output	
Symbol	Rated output [kW]
11K	11
15K	15
22K	22

App. 7.2.3 Specifications

These are servo amplifiers of 11 kW to 22 kW that does not use a regenerative resistor as standard accessory. When using any of these servo amplifiers, always use the MR-RB5R, MR-RB9F, MR-RB9T, MR-RB5K-4 or MR-RB6K-4 regenerative option.

App. 8 Setting of added parameters for MR-J4-_B_-RJ020 servo amplifier

The following explains the setting procedures of parameters added for the MR-J4-_B_-RJ020 servo amplifier (at J2S compatibility mode) using a motion controller.

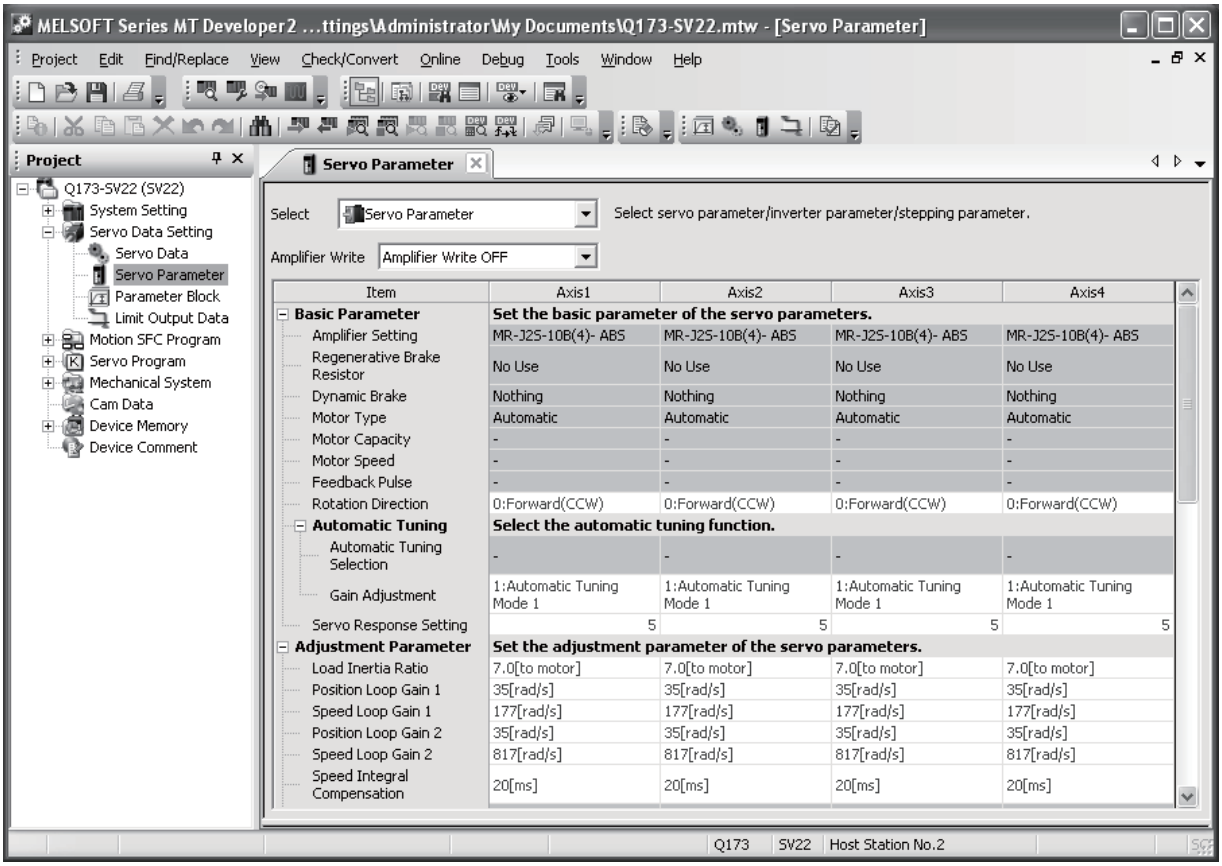
App. 8.1 Combination of target motion controllers and peripheral software

Series	Motion controller model	Peripheral software for motion controller
Q series	Q172CPU(N) Q173CPU(N)	MELSOFT MT Works2 (SW1DNC-MTW2-E) MT Developer (SW6RNC-GSVE)
A series	A171SHCPU(N) A172SHCPU(N) A173UHCPU	SW3RNC-GSVE

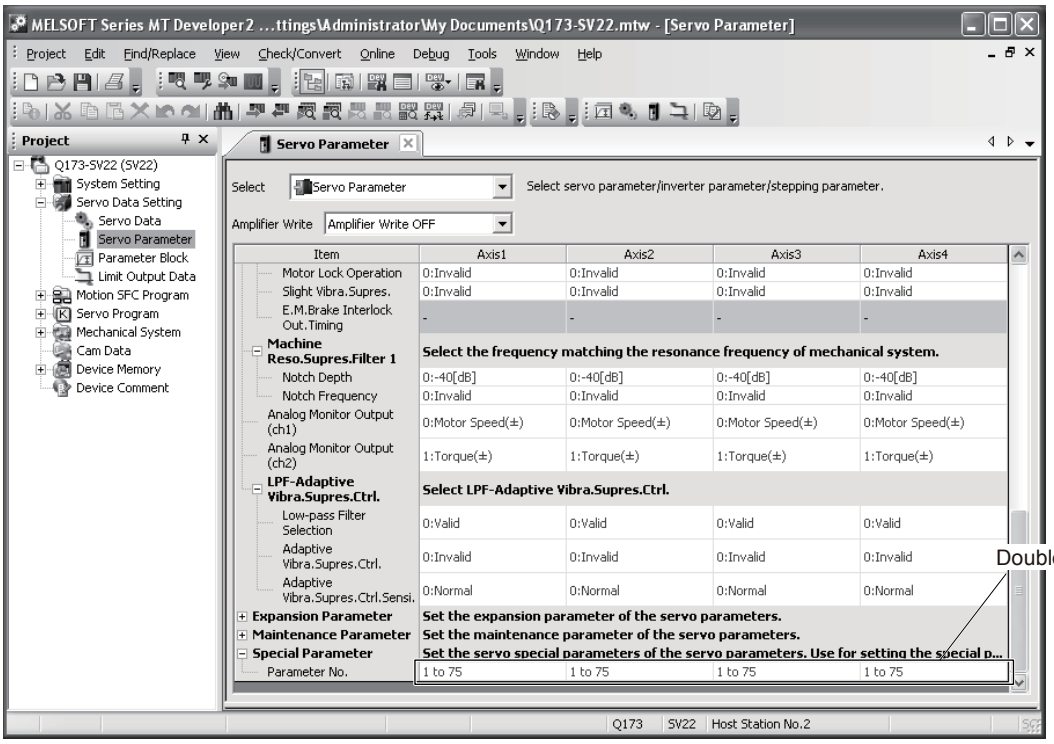
App. 8.2 Parameter setting procedure

App. 8.2.1 MELSOFT MT Works2

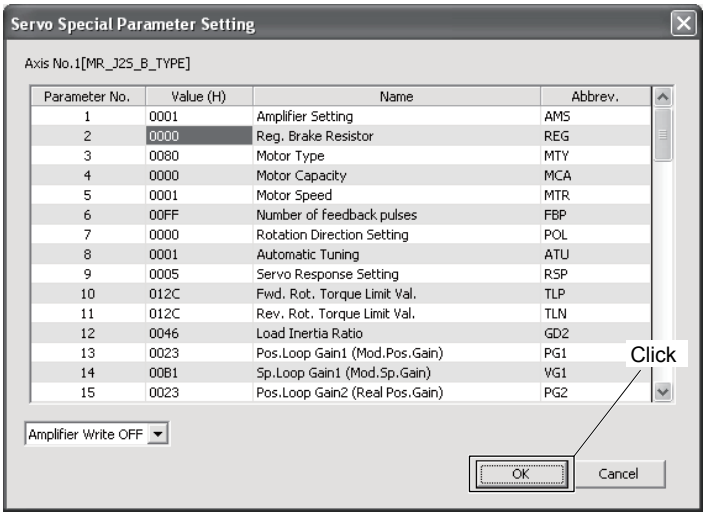
(1) Open the "Servo Parameter" window.



(2) To display the "Servo Special Parameter Setting" dialog box, double-click the "1 to 75" setting cell of "Parameter No." of special parameter.



(3) Change any setting values of parameters.
To enable the settings, change relevant parameters and click "OK".


Servo Special Parameter Setting
Axis No.1[MR_J2S_B_TYPE]
Parameter No.
Value (H)
Name
Abbrev.
1 0001 Amplifier Setting AMS
2 0000 Reg. Brake Resistor REG
3 0080 Motor Type MTY
4 0000 Motor Capacity MCA
5 0001 Motor Speed MTR
6 00FF Number of feedback pulses FBP
7 0000 Rotation Direction Setting POL
8 0001 Automatic Tuning ATU
9 0005 Servo Response Setting RSP
10 012C Fwd. Rot. Torque Limit Val. TLP
11 012C Rev. Rot. Torque Limit Val. TLN
12 0046 Load Inertia Ratio GD2
13 0023 Pos.Loop Gain1 (Mod.Pos.Gain) PG1
14 00B1 Sp.Loop Gain1 (Mod.Sp.Gain) VG1
15 0023 Pos.Loop Gain2 (Real Pos.Gain) PG2
Amplifier Write OFF
Click
OK
Cancel

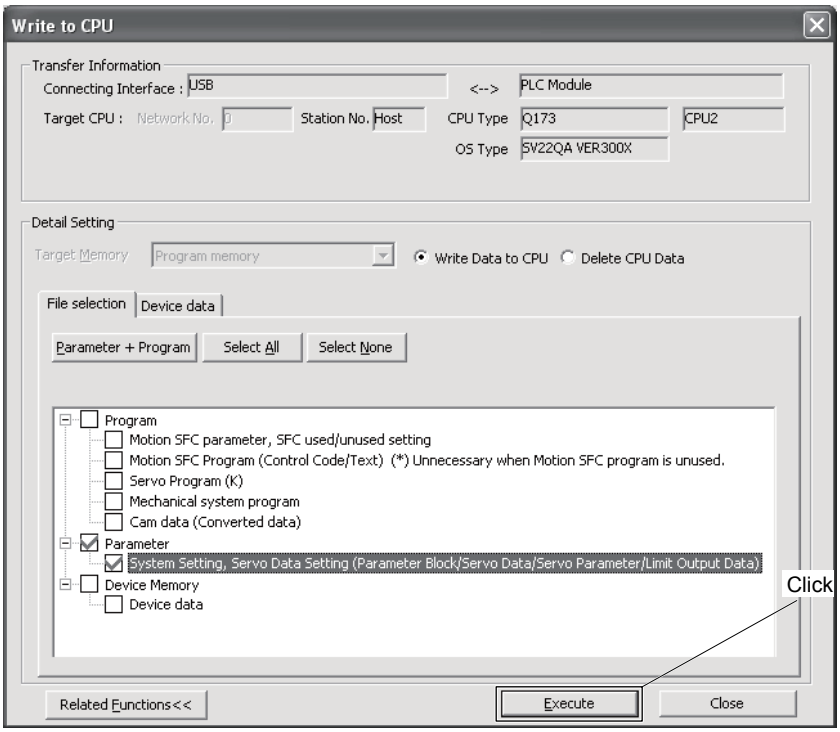
The following shows changing examples of parameter settings.

(a) Change of [Pr. 2 Reg. Brake Resistor] (hexadecimal parameter)
When changing the setting value to "0020", input "0020" directly.

(b) Change of [Pr. 12 Load Inertia Ratio] (decimal parameter)
When changing the setting value to "7.0", input "0046", the value "70" converted to hexadecimal.

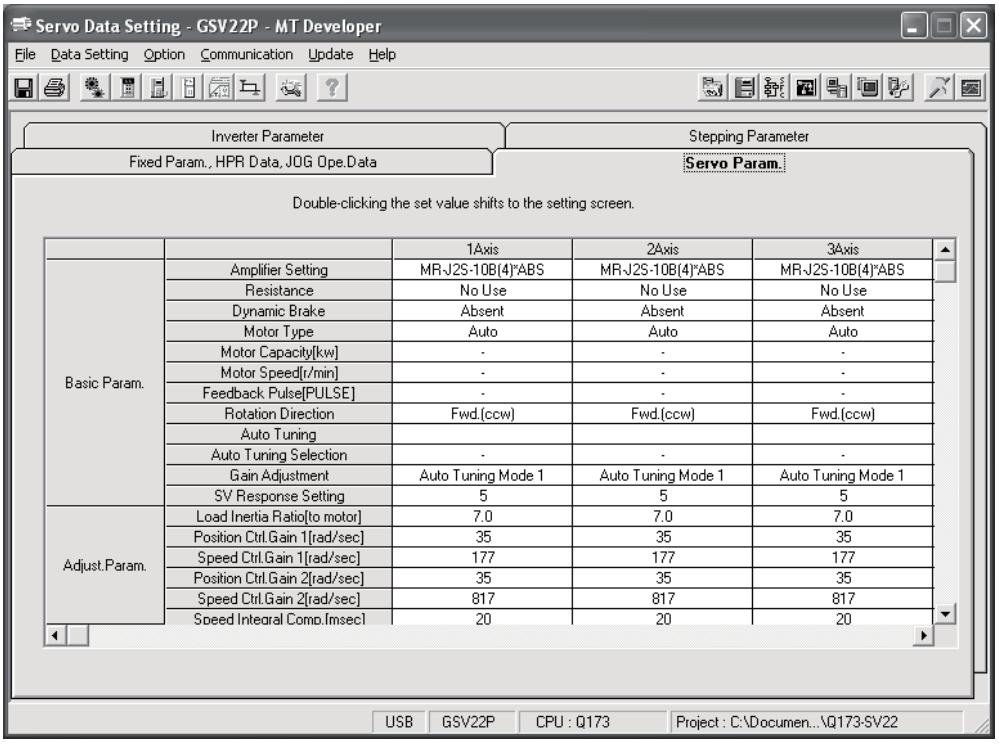
(c) Change of [Pr. 39 Electronic dynamic brake operating time] (decimal parameter)
When changing the setting value to "10000", input "2710", the value "10000" converted to hexadecimal.

(4) Write the changed parameter with communication. Clicking "Execute" will start writing.

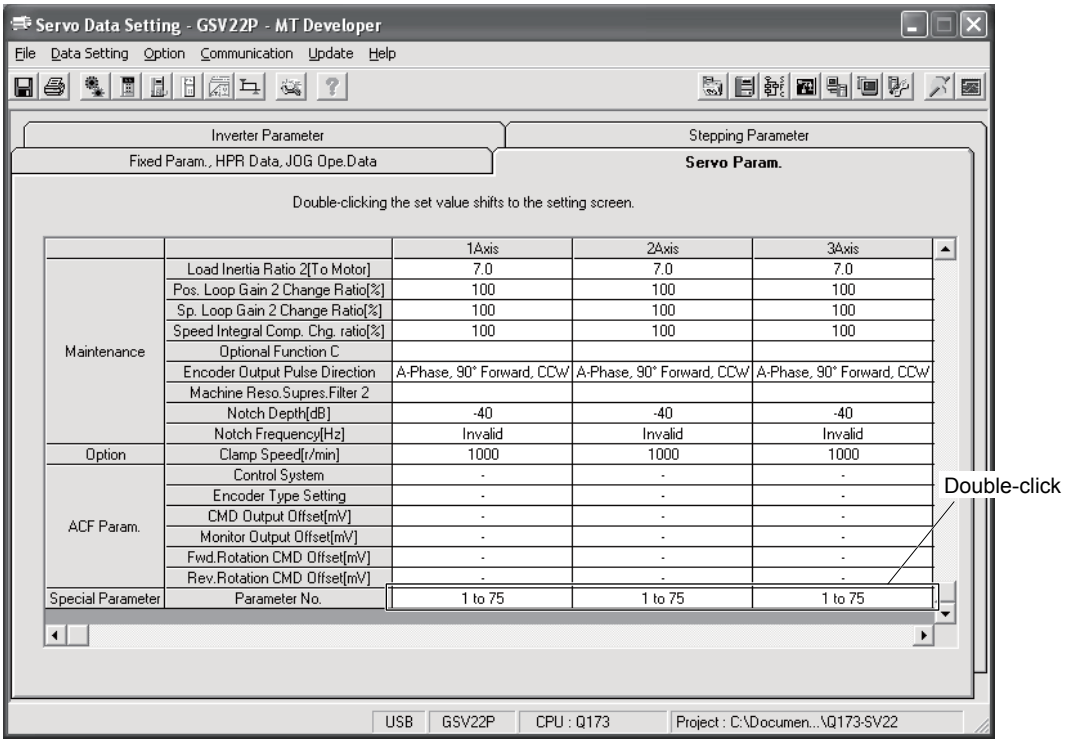


App. 8.2.2 MT Developer (software version 00K or later)

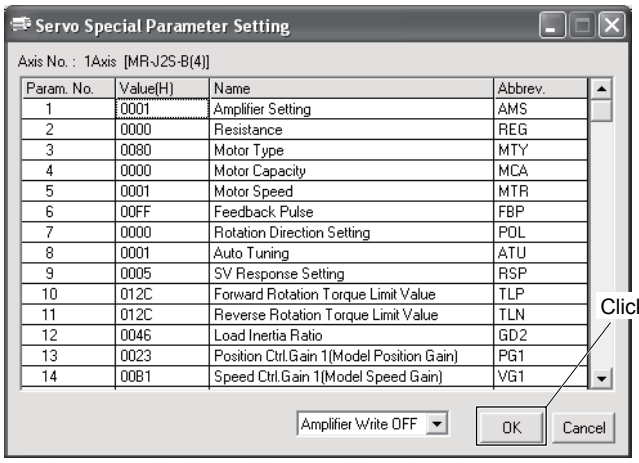
(1) Open the "Servo Data Setting" window.


Servo Data Setting - GSV22P - MT Developer
File Data Setting Option Communication Update Help
Inverter Parameter
Stepping Parameter
Fixed Param., HPR Data, JOG Ope.Data
Servo Param.
Double-clicking the set value shifts to the setting screen.
1Axis 2Axis 3Axis
Basic Param.
Amplifier Setting MR-J2S-10B(4)*ABS MR-J2S-10B(4)*ABS MR-J2S-10B(4)*ABS
Resistance No Use No Use No Use
Dynamic Brake Absent Absent Absent
Motor Type Auto Auto Auto
Motor Capacity[kw] - - -
Motor Speed[r/min] - - -
Feedback Pulse[PULSE] - - -
Rotation Direction Fwd.(ccw) Fwd.(ccw) Fwd.(ccw)
Auto Tuning
Auto Tuning Selection - - -
Gain Adjustment Auto Tuning Mode 1 Auto Tuning Mode 1 Auto Tuning Mode 1
SV Response Setting 5 5 5
Adjust.Param.
Load Inertia Ratio[to motor] 7.0 7.0 7.0
Position Ctrl.Gain 1[rad/sec] 35 35 35
Speed Ctrl.Gain 1[rad/sec] 177 177 177
Position Ctrl.Gain 2[rad/sec] 35 35 35
Speed Ctrl.Gain 2[rad/sec] 817 817 817
Speed Integral Comp.[msec] 20 20 20
USB GSV22P CPU : Q173 Project : C:\Documen...\Q173-SV22

(2) To display the "Servo Special Parameter Setting" dialog box, double-click the "1 to 75" setting cell of "Parameter No." of special parameter on the "Servo Param." tab.


Servo Data Setting - GSV22P - MT Developer
File Data Setting Option Communication Update Help
Inverter Parameter
Stepping Parameter
Fixed Param., HPR Data, JOG Ope.Data
Servo Param.
Double-clicking the set value shifts to the setting screen.
1Axis 2Axis 3Axis
Maintenance
Load Inertia Ratio 2[To Motor] 7.0 7.0 7.0
Pos. Loop Gain 2 Change Ratio[%] 100 100 100
Sp. Loop Gain 2 Change Ratio[%] 100 100 100
Speed Integral Comp. Chg. ratio[%] 100 100 100
Optional Function C
Encoder Output Pulse Direction A-Phase, 90° Forward, CCW A-Phase, 90° Forward, CCW A-Phase, 90° Forward, CCW
Machine Reso.Supres.Filter 2
Notch Depth[dB] -40 -40 -40
Notch Frequency[Hz] Invalid Invalid Invalid
Option
Clamp Speed[r/min] 1000 1000 1000
ACF Param.
Control System - - -
Encoder Type Setting - - -
CMD Output Offset[mV] - - -
Monitor Output Offset[mV] - - -
Fwd.Rotation CMD Offset[mV] - - -
Rev.Rotation CMD Offset[mV] - - -
Special Parameter
Parameter No. 1 to 75 1 to 75 1 to 75
Double-click
USB GSV22P CPU : Q173 Project : C:\Documen...\Q173-SV22

(3) Change any set values of parameters.
To enable the settings, change relevant parameters and click "OK".


Servo Special Parameter Setting
Axis No. : 1Axis [MR-J2S-B(4)]
Param. No. | Value[H] | Name | Abbrev.
1 | 0001 | Amplifier Setting | AMS
2 | 0000 | Resistance | REG
3 | 0080 | Motor Type | MTY
4 | 0000 | Motor Capacity | MCA
5 | 0001 | Motor Speed | MTR
6 | 00FF | Feedback Pulse | FBP
7 | 0000 | Rotation Direction Setting | POL
8 | 0001 | Auto Tuning | ATU
9 | 0005 | SV Response Setting | RSP
10 | 012C | Forward Rotation Torque Limit Value | TLP
11 | 012C | Reverse Rotation Torque Limit Value | TLN
12 | 0046 | Load Inertia Ratio | GD2
13 | 0023 | Position Ctrl.Gain 1(Model Position Gain) | PG1
14 | 00B1 | Speed Ctrl.Gain 1(Model Speed Gain) | VG1
Amplifier Write OFF
OK
Cancel
Click

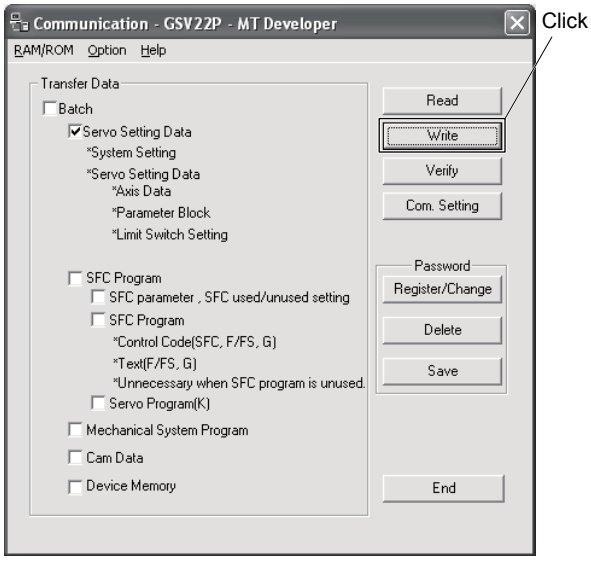
The following shows changing examples of parameter settings.

(a) Change of [Pr. 2 Reg. Brake Resistor] (hexadecimal parameter)
When changing the setting value to "0020", input "0020" directly.

(b) Change of [Pr. 12 Load Inertia Ratio] (decimal parameter)
When changing the setting value to "7.0", input "0046", the value "70" converted to hexadecimal.

(c) Change of [Pr. 39 Electronic dynamic brake operating time] (decimal parameter)
When changing the setting value to "10000", input "2710", the value "10000" converted to hexadecimal.

(4) Write the changed parameter with communication. Clicking "Write" will start writing.



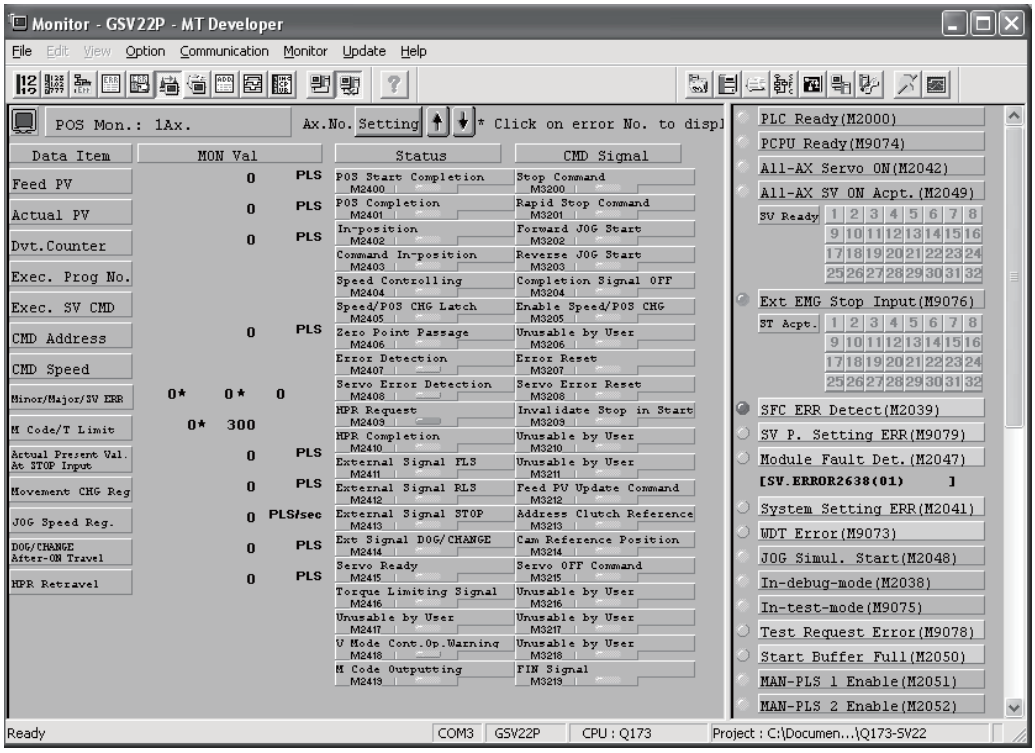
App. 8.2.3 MT Developer (software version 00H or earlier) or SW3RNC-GSVE

POINT
●Set as follows when the servo system controller and servo amplifier are in communication.

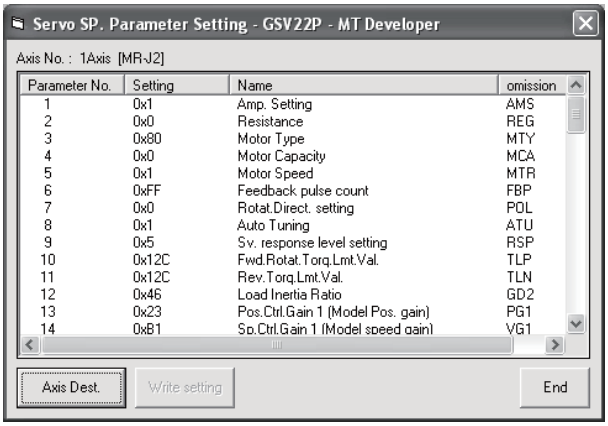
(1) Setting procedure

(a) Open the monitor window.

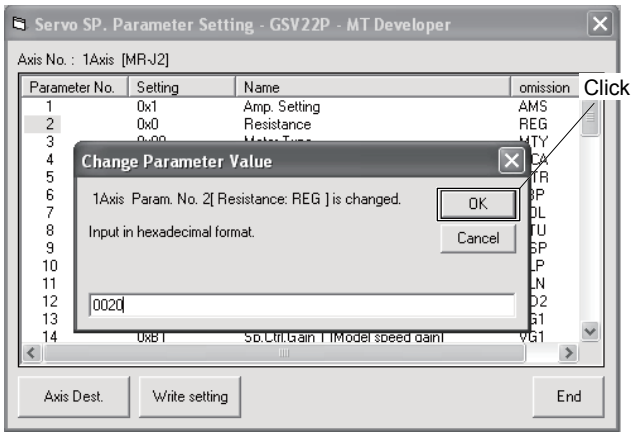
Set the monitor window to the monitor stop condition with the positioning monitor.



(b) To display the "Servo SP. Parameter Setting" dialog, use the shortcut key "Ctrl" + "Shift" + "Alt" + "0" on monitor window.


Servo SP. Parameter Setting - GSV22P - MT Developer
Axis No. : 1Axis [MR-J2]
Parameter No. | Setting | Name | omission
1 | 0x1 | Amp. Setting | AMS
2 | 0x0 | Resistance | REG
3 | 0x80 | Motor Type | MTY
4 | 0x0 | Motor Capacity | MCA
5 | 0x1 | Motor Speed | MTR
6 | 0xFF | Feedback pulse count | FBP
7 | 0x0 | Rotat.Direct. setting | POL
8 | 0x1 | Auto Tuning | ATU
9 | 0x5 | Sv. response level setting | RSP
10 | 0x12C | Fwd.Rotat.Torq.Lmt.Val. | TLP
11 | 0x12C | Rev.Torq.Lmt.Val. | TLN
12 | 0x46 | Load Inertia Ratio | GD2
13 | 0x23 | Pos.Ctrl.Gain 1 (Model Pos. gain) | PG1
14 | 0xB1 | Sp.Ctrl.Gain 1 (Model speed gain) | VG1
Axis Dest.
Write setting
End

(3) Change any set values of parameters.
After the setting of a relevant parameter, click "OK" to write the setting to the motion controller and servo amplifier.



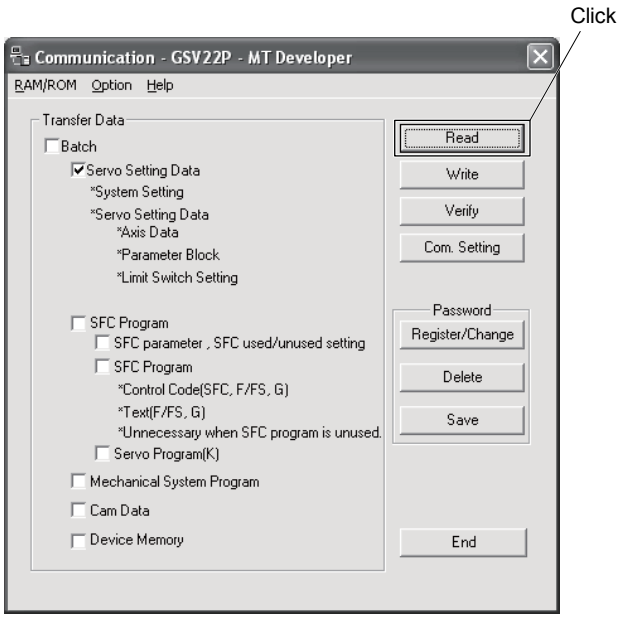
The following shows changing examples of parameter settings.

(a) Change of [Pr. 2 Reg. Brake Resistor] (hexadecimal parameter)
When changing the setting value to "0020", input "0020" directly.

(b) Change of [Pr. 12 Load Inertia Ratio] (decimal parameter)
When changing the setting value to "7.0", input "0046", the value "70" converted to hexadecimal.

(c) Change of [Pr. 39 Electronic dynamic brake operating time] (decimal parameter)
When changing the setting value to "10000", input "2710", the value "10000" converted to hexadecimal.

(4) The parameter value set in (3) will not be reflected in a project. Read the servo parameter with communication and save it in the project.



REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	Revision	
Jun. 2013	SH(NA)030125-A	First edition	
Aug. 2013	SH(NA)030125-B	MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.	
		Safety Instructions (1) Transportation and installation	Partially changed.
		Section 1.1	Partially added.
		Section 1.2 (3)	Newly added.
		Section 1.3.1	Specifications of MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 1.4	Servo motors for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 1.6	Partially added and partially changed.
		Section 1.7.1 (1) to (6)	Partially changed.
		Section 1.7.1 (7), (8)	Newly added.
		Section 1.7.2	Partially changed.
		Section 1.7.3	Partially changed.
		Section 1.8	CAUTION is partially changed.
		Section 1.8 (1)	Partially added and partially changed in POINT.
		Section 1.8 (2)	Partially changed.
		Section 1.8 (3)	Newly added.
		Section 1.9 (7), (8)	Newly added.
		Chapter 2	CAUTION is partially changed. POINT is partially changed.
		Section 2.1 (1)	Partially added and partially changed.
		Section 3.1 (1) to (6)	Partially changed.
		Section 3.1 (7), (8)	Newly added.
		Section 3.2.1	Partially added and partially changed.
		Section 3.2.2	Partially added and partially changed.
		Section 3.3.1	Partially changed.
		Section 3.3.2	CAUTION is added. POINT is partially deleted.
		Section 3.4	CN3 connector 15 pin is changed to DB.
		Section 3.5.2	DB (Dynamic brake interlock) is added.
		Section 3.7.1	Circuit diagram of CN3 connector 15 pin (DB) is added.
		Section 4.3.1	Partially changed.
		Section 4.5.2	Partially changed.
		Section 5.1.1	Partially added and partially changed.
		Section 5.1.2	Partially added and partially changed.
		Section 5.1.3	Partially added and partially changed. [Pr. 58] is added.
		Section 5.2.1	[Pr. 2] setting is changed.
		Section 5.2.2	Partially changed. Initial values (11 kW or more) are added to [Pr. 13] to [Pr. 17].
		Section 5.2.3	Partially changed. [Pr. 58] is added.
		Section 7.2.3	Partially changed.
		Section 8.1	Partially changed.
		Section 8.2	Partially added and partially changed.
		Section 8.3	Partially added and partially changed.
		Section 8.4	Partially added and partially changed.
		Section 9.1 (9)	Partially added and partially changed.
		Section 9.1 (12), (13)	Newly added.
		Section 10.1	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 10.2	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 10.3.1	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.

Print Data	*Manual Number	Revision	
Aug. 2013	SH(NA)030125-B	Section 10.3.2	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 10.5	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.1.2	Partially changed.
		Section 11.2.1 (1), (2)	Regenerative options for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.2.2 (2)	Characteristics for MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.2.3	Partially added and partially changed.
		Section 11.2.4	Partially added.
		Section 11.2.5	Partially added.
		Section 11.3	POINT is partially changed.
		Section 11.3.1	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.3.3	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.3.4	Partially added.
		Section 11.4	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.5	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.6 (2)	DB is added to 15 pin.
		Section 11.7	Partially added and partially changed.
		Section 11.9	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.10	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.11	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.12	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.14 (2) (b)	Partially changed.
		Section 11.15	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.16	Specifications for using MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
		Section 11.17	Newly added.
		Section 11.18	Newly added.
		Chapter 12	POINT is partially changed.
		Section 13.2.1 (2)	Partially changed.
		Section 13.2.2 (1)	[Pr. PA02] setting is changed.
		Section 13.2.2 (2)	Partially changed.
		Section 13.2.2 (4)	Setting value "06: DB (Dynamic brake interlock)" is added to [Pr. PD07].
		Section 13.3.1	Partially changed.
		App. 1	Partially added and partially changed.
		App. 5	MR-J4-11KB(4)-RJ020 to MR-J4-22KB(4)-RJ020 are added.
Mar. 2014	SH(NA)030125-C	100 V class MR-J4 series servo amplifiers are added.	
		«About the manual»	Partially changed.
		Section 1.1	Partially changed.
		Section 1.2 (1) to (3)	Partially changed.
		Section 1.2 (4)	Newly added.
		Section 1.3.1 (1), (2)	Partially added and partially changed.
		Section 1.3.1 (3)	Newly added.
		Section 1.4 (3)	Newly added.
		Section 1.5	Partially added.
		Section 1.6	Partially added and partially changed.
		Section 1.7.1	Partially changed.
		Section 1.7.2	Partially changed.

Print Data	*Manual Number	Revision	
Mar. 2014	SH(NA)030125-C	Section 1.7.3	Partially changed.
		Section 1.8	Partially changed.
		Section 1.9 (1) to (8)	Partially changed.
		Section 1.9 (9)	Newly added.
		Chapter 2	POINT is partially changed.
		Section 2.1 (1)	Partially added and partially changed.
		Section 3.1 (1) to (8)	Partially changed.
		Section 3.1 (9)	Newly added.
		Section 3.2.1	Partially changed.
		Section 3.3.1	Partially added and partially changed.
		Section 3.3.2	Partially changed.
		Section 3.3.3	Partially added and partially changed.
		Section 3.8.1	Partially changed.
		Section 3.8.2	Partially changed.
		Section 3.9	Partially changed.
		Section 4.1.1	Partially changed.
		Section 4.1.2	Partially changed.
		Section 4.2	Partially changed.
		Section 4.3.1	Partially changed.
		Section 5.1.1	Partially changed.
		Section 5.2.1	Partially changed.
		Section 5.2.2	Partially changed.
		Section 5.2.3	Partially changed.
		Section 8.2	Partially added and partially changed.
		Section 8.3	Partially added and partially changed.
		Section 9.1 (1) to (13)	Partially changed.
		Section 9.1 (14), (15)	Newly added.
		Section 10.1	Partially changed.
		Section 10.2	Characteristics for MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 10.3.2	Partially changed.
		Section 10.5	POINT is added. Characteristics for MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.1.1	Partially added and partially changed.
		Section 11.2.1 (3)	Regenerative options for MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.2.2 (2)	Characteristics for MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.2.3	Partially added.
		Section 11.2.4	Partially changed.
		Section 11.2.5	Partially changed.
		Section 11.3.3	Partially changed.
		Section 11.5	Partially changed.
		Section 11.7	Partially changed.
		Section 11.8	The MR-BAT6V1BJ battery for junction battery cable is added.
		Section 11.9	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.10	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.12	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.13	Partially added.
		Section 11.14	Partially changed.
		Section 11.15	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.16	Specifications for using MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		Section 11.17	Partially added and partially changed.
		Section 11.18	Partially changed.

Print Data	*Manual Number	Revision	
Mar. 2014	SH(NA)030125-C	Chapter 12	Using MR-BAT6V1BJ battery for junction battery cable is added.
		Chapter 13	Partially added and partially changed in POINT.
		Section 13.1.1	Partially changed.
		Section 13.1.2	Partially changed.
		Section 13.2	[Pr. PD11], [Pr. PD15] to [Pr. PD17], [Pr. PD20], [Pr. PD30] to [Pr. PD32] are added.
		Section 13.2.2 (1) to (3), (5)	Partially changed.
		Section 13.2.2 (4)	[Pr. PD11], [Pr. PD15] to [Pr. PD17], [Pr. PD20], [Pr. PD30] to [Pr. PD32] are added.
		Section 13.3.1	[AL. 3D] and [AL. 82] are added.
		App. 1 (3)	Newly added.
		App. 2	Partially added.
		App. 3	Partially added and partially changed.
		App. 5	Contents of MR-J4-10B1-RJ020 to MR-J4-40B1-RJ020 are added.
		App. 6	Partially changed.
		App. 7	Newly added.
		App. 8	Newly added.

This manual confers no industrial property rights or any rights of any other kind, nor does it confer any patent licenses. Mitsubishi Electric Corporation cannot be held responsible for any problems involving industrial property rights which may occur as a result of using the contents noted in this manual.

© 2013 MITSUBISHI ELECTRIC CORPORATION

Country/Region	Sales office	Tel/Fax
USA	MITSUBISHI ELECTRIC AUTOMATION, INC. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.	Tel : +1-847-478-2100 Fax : +1-847-478-2253
Mexico	MITSUBISHI ELECTRIC AUTOMATION, INC. Mexico Branch Mariano Escobedo #69, Col.Zona Industrial, Tlalnepantla Edo, C.P.54030, México	Tel : +52-55-9171-7600 Fax : +52-55-9171-7649
Brazil	MITSUBISHI ELECTRIC DO BRASIL COMÉRCIO E SERVIÇOS LTDA. Rua Jussara, 1750- Bloco B Anexo, Jardim Santa Cecilia, CEP 06465-070, Barueri - SP, Brasil	Tel : +55-11-4689-3000 Fax : +55-11-4689-3016
Germany	MITSUBISHI ELECTRIC EUROPE B.V. German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany	Tel : +49-2102-486-0 Fax : +49-2102-486-1120
UK	MITSUBISHI ELECTRIC EUROPE B.V. UK Branch Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, U.K.	Tel : +44-1707-28-8780 Fax : +44-1707-27-8695
Italy	MITSUBISHI ELECTRIC EUROPE B.V. Italian Branch Centro Direzionale Colleoni - Palazzo Sirio Viale Colleoni 7, 20864 Agrate Brianza(Milano) Italy	Tel : +39-039-60531 Fax : +39-039-6053-312
Spain	MITSUBISHI ELECTRIC EUROPE, B.V. Spanish Branch Carretera de Rubí, 76-80-Apdo. 420, 08173 Sant Cugat del Vallés (Barcelona), Spain	Tel : +34-935-65-3131 Fax : +34-935-89-1579
France	MITSUBISHI ELECTRIC EUROPE B.V. French Branch 25, Boulevard des Bouvets, F-92741 Nanterre Cedex, France	Tel : +33-1-55-68-55-68 Fax : +33-1-55-68-57-57
Czech Republic	MITSUBISHI ELECTRIC EUROPE B.V. Czech Branch Avenir Business Park, Radlicka 751/113e, 158 00 Praha5, Czech Republic	Tel : +420-251-551-470 Fax : +420-251-551-471
Poland	MITSUBISHI ELECTRIC EUROPE B.V. Polish Branch ul. Krakowska 50, 32-083 Balice, Poland	Tel : +48-12-630-47-00 Fax : +48-12-630-47-01
Russia	MITSUBISHI ELECTRIC EUROPE B.V. Russian Branch St. Petersburg office Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720; RU-195027 St. Petersburg, Russia	Tel : +7-812-633-3497 Fax : +7-812-633-3499
Turkey	MITSUBISHI ELECTRIC TURKEY A.Ş Ümraniye Branch Şerifali Mahallesi Nutuk Sokak No:5 TR-34775 Ümraniye, İstanbul, Türkey	Tel : +90-216-526-3990 Fax : +90-216-526-3995
South Africa	ADROIT TECHNOLOGIES 20 Waterford Office Park, 189 Witkoppen Road, ZA-Fourways, South Africa	Tel : +27-11-658-8100 Fax : +27-11-658-8101
China	MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. No.1386 Hongqiao Road, Mitsubishi Electric Automation Center, Changning District, Shanghai, China	Tel : +86-21-2322-3030 Fax : +86-21-2322-3000
Taiwan	SETSUYO ENTERPRISE CO., LTD. 6F, No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan, R.O.C.	Tel : +886-2-2299-2499 Fax : +886-2-2299-2509
Korea	MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. 1480-6, Gayang-Dong, Gangseo-Gu, Seoul, 157-200, Korea	Tel : +82-2-3660-9510 Fax : +82-2-3664-8372/8335
Singapore	MITSUBISHI ELECTRIC ASIA PTE. LTD. 307, Alexandra Road, Mitsubishi Electric Building, Singapore 159943	Tel : +65-6473-2308 Fax : +65-6476-7439
Thailand	MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO., LTD. 12th Floor, SV.City Building, Office Tower 1, No. 896/19 and 20 Rama 3 Road, Kwaeng Bangpongpang, Khet Yannawa, Bangkok 10120,Thailand	Tel : +66-2682-6522 to 6531 Fax : +66-2682-6020
Indonesia	PT. MITSUBISHI ELECTRIC INDONESIA Gedung Jaya 11th Floor, JL. MH. Thamrin No.12, Jakarta Pusat 10340, Indonesia	Tel : +62-21-3192-6461 Fax : +62-21-3192-3942
Vietnam	MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED Unit 01 - 04, 10th Floor, Vincom Center, 72 Le Thanh Ton Street, District 1, Ho Chi Minh City, Vietnam	Tel : +84-8-3910-5945 Fax : +84-8-3910-5947
India	MITSUBISHI ELECTRIC INDIA PVT. LTD. Pune Branch Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune, 411026, Maharashtra State, India	Tel : +91-20-2710-2000 Fax : +91-20-2710-2100
Australia	MITSUBISHI ELECTRIC AUSTRALIA PTY. LTD. 348 Victoria Road, P.O. Box 11, Rydalmere, N.S.W 2116, Australia	Tel : +61-2-9684-7777 Fax : +61-2-9684-7245

MELSERVO is a trademark or registered trademark of Mitsubishi Electric Corporation in Japan and/or other countries.
Microsoft, Windows, Internet Explorer, and Windows Vista are registered trademarks or trademarks of Microsoft Corporation in the United States, Japan, and/or other countries.
Intel, Pentium, and Celeron are trademarks of Intel Corporation in the United States and/or other countries.
All other product names and company names are trademarks or registered trademarks of their respective companies.

Warranty

1. Warranty period and coverage

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]

The term of warranty for Product is twelve (12) months after your purchase or delivery of the Product to a place designated by you or eighteen (18) months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Limitations]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
- (i) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
- (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval
- (iii) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
- (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
- (v) any replacement of consumable parts (battery, fan, smoothing capacitor, etc.)
- (vi) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
- (vii) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
- (viii) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of responsibility for compensation against loss of opportunity, secondary loss, etc.

Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

(1) For the use of our General-Purpose AC Servo, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in General-Purpose AC Servo, and a backup or fail-safe function should operate on an external system to General-Purpose AC Servo when any failure or malfunction occurs.

(2) Our General-Purpose AC Servo is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

MODEL	MR-J4-B-RJ020 MR-J4-T20 INSTRUCTION
MODEL CODE	1CW814

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BLDG MARUNOUCHI TOKYO 100-8310

SH (NA) 030125-C (1403) MEE Printed in Japan

This Instruction Manual uses recycled paper.
Specifications are subject to change without notice.